SEPTEMBER 1965 35 CENTS

Popular Science

Monthly

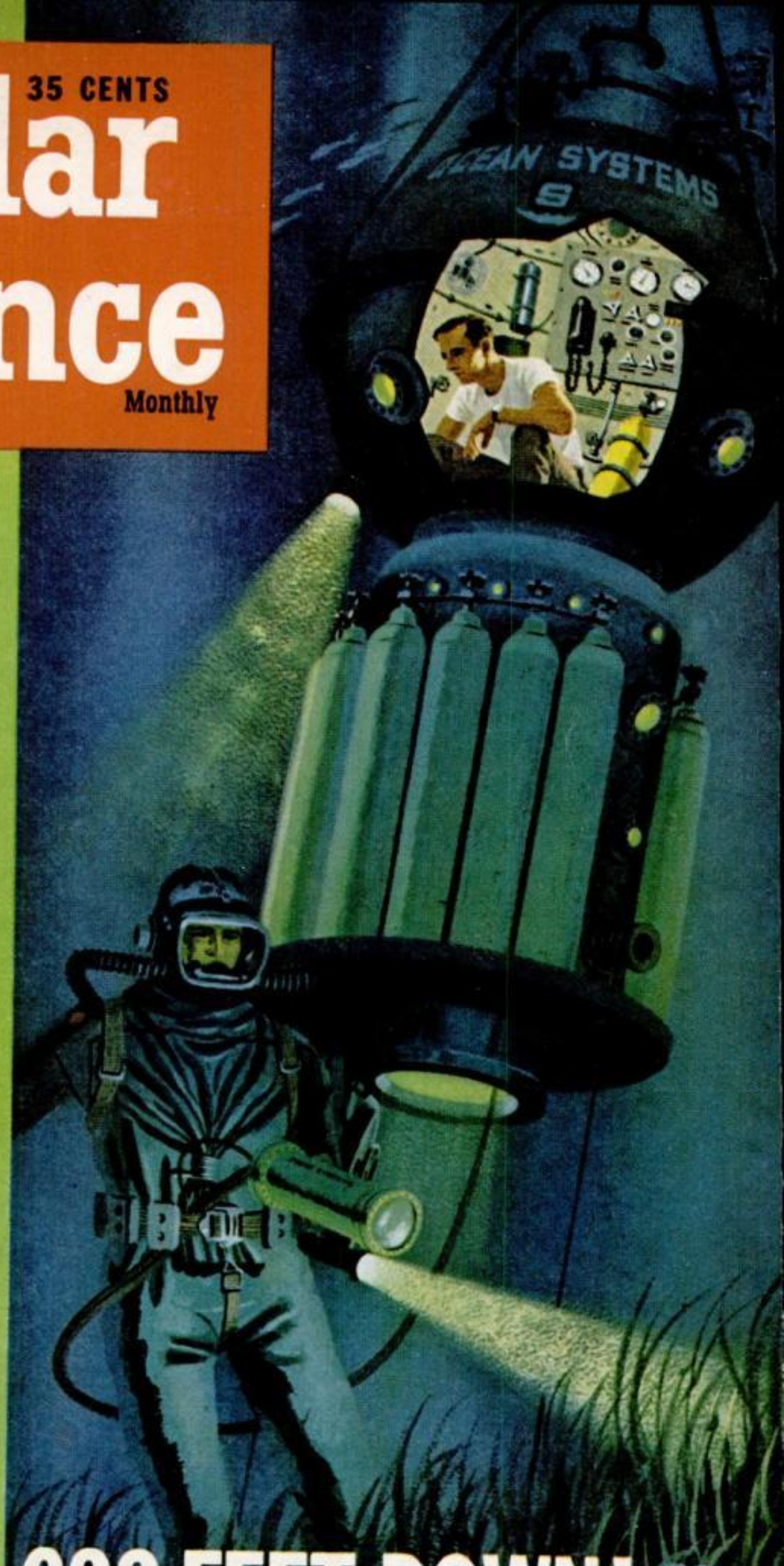
HOW TO KEEP YOUR CAR LOOKING NEW

IMPROVE YOUR HOME!
48 PAGES OF NEW IDEAS:

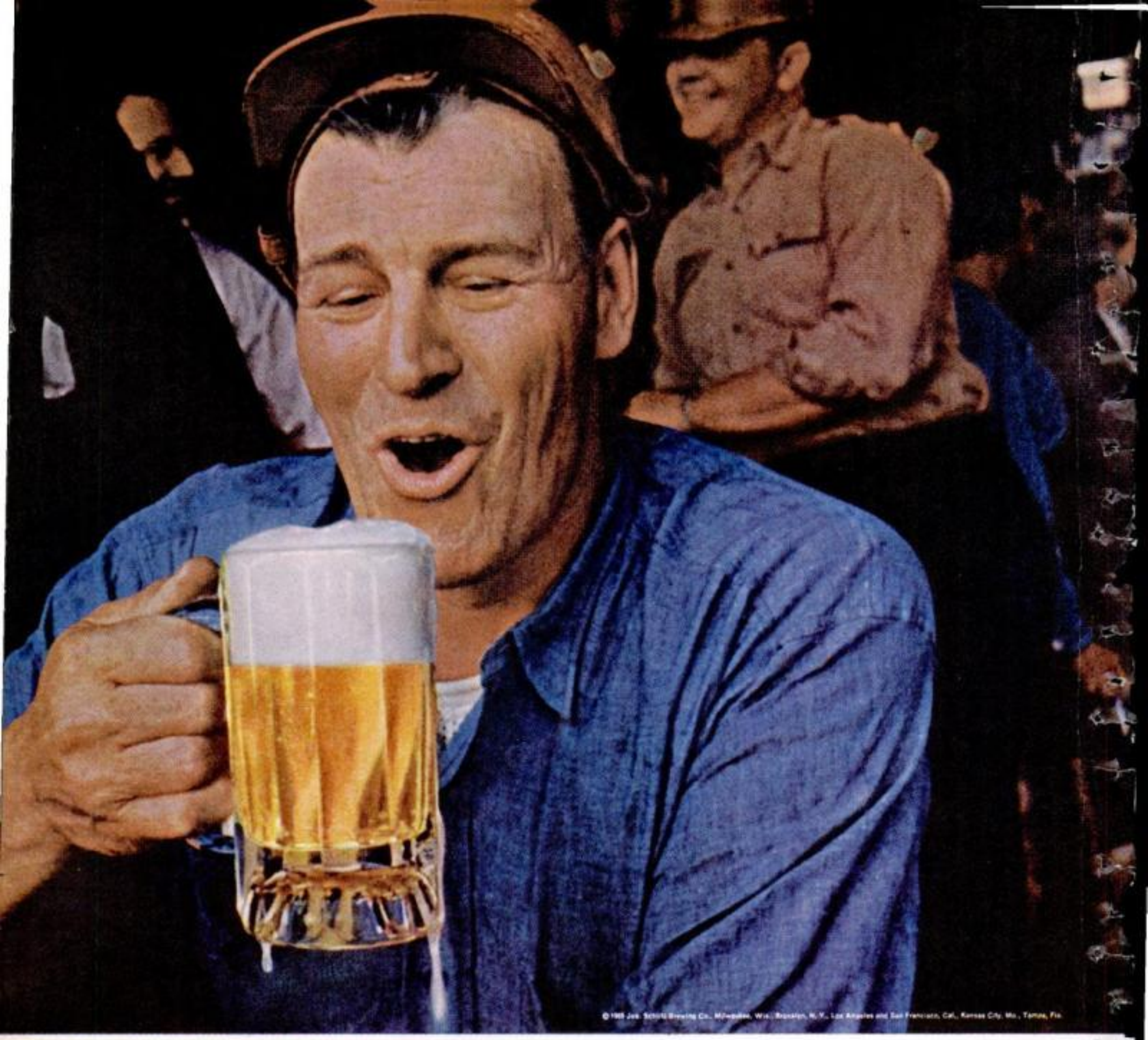
ut Your Fuel-Oil Bill up to 25%
Tile Your Own Bathroom
The Latest in Better Roofing
asy Plumbing with Copper Tubing
Tricks with Plasterboard
Put in New Lighting Fixtures
Lay a Luxury Floor Fast
ew Sidings with Built-In Paint
...and lots more

iny Electric Eye to Guard Your Home

NEW '66 CARS
nside Story on Plymouths, Dodges, and Chryslers



632 FEET DOWN!
Jon Lindbergh Works on Ocean Floor



The big fella here is a one-man wrecking crew. But he's a real pushover for a gal named Gladys and a beer named Schlitz.

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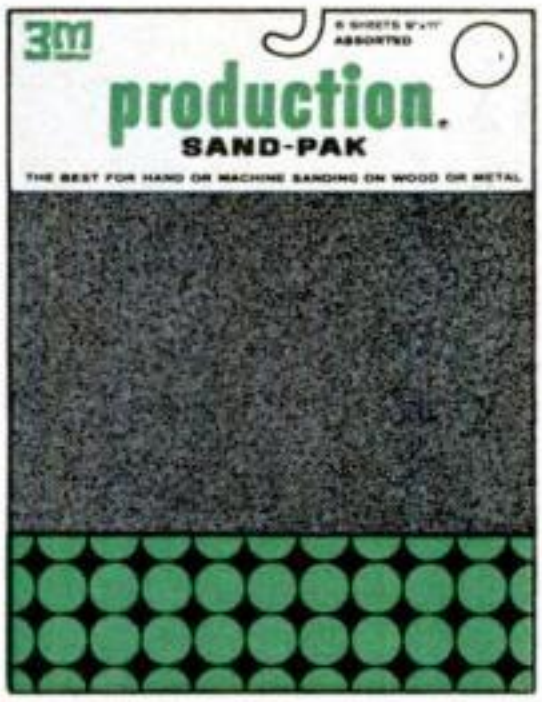

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September 1965

What'll happen to the jukeboxes when silver coins are replaced? Nothing. Here's why. Page 64.

Verdict on Ford's new Bronco: Like a Jeep in the rough, like a Mustang on the road. Page 47.

Trouble on the high seas? Here's how science's electronic lifeline reaches out to help. Page 86.

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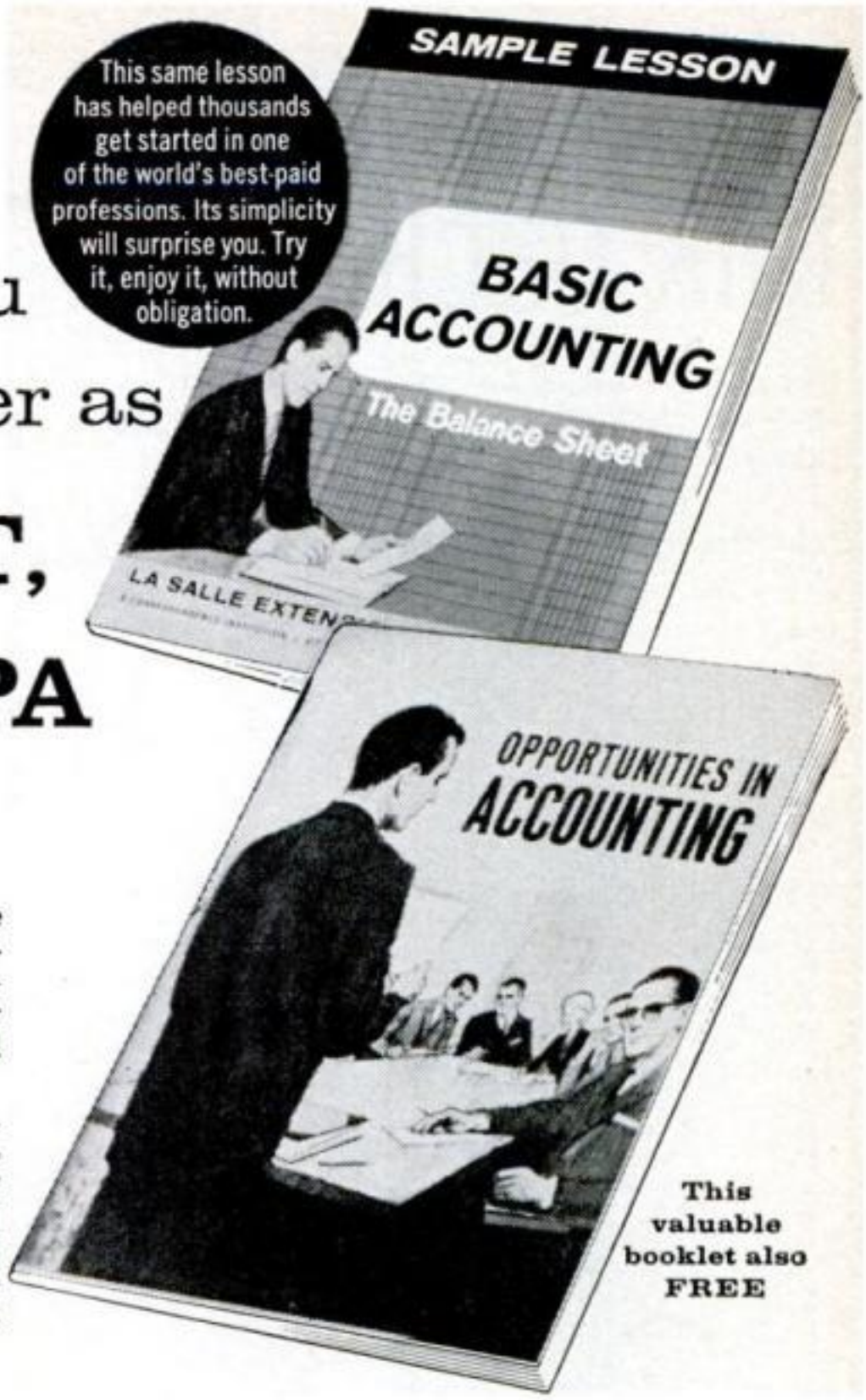
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PS readers talk back

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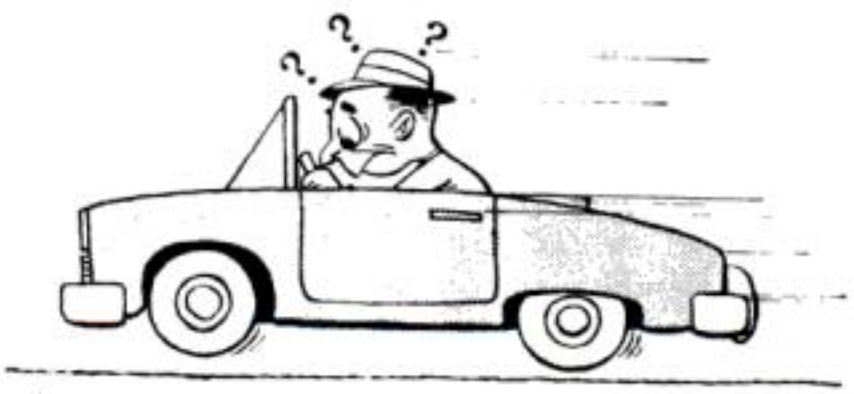
Teaching "Old" Drivers New Tricks

Smokey Yunick's car clinic is interesting and instructive, all right, but how hep is he to the one thing most dangerous to driving safety for all of us?

That's the constant changing in placement of instruments and controls from year to year and car to car.

You wouldn't expect perfect letters from a stenographer if the letters on her keyboard changed with every typewriter; nor expect fine music from a pianist whose keyboard changed with every brand of piano.

Just so with driving a car. Yet with every new model, a motorist is up against a hazard



—right inside his own car—more dangerous than any on the highway.

L. M. Prince, Bangor, Me.

Watch That CB Antenna!

The information and diagram on page 164 in Ronald M. Benrey's article [Getting the Most Out of CB Radio" June], relating to the authorized height of a CB antenna attached to a television receiving antenna, was incorrect.

What Mr. Benrey said would be correct if a CB antenna were attached to a transmitting antenna of another authorized radio station. However, Section 95.37 (c) of the Commission's rules provides that when a Class D station antenna is installed upon an antenna structure which is used solely for receiving purposes, neither the CB, TV antennas, nor the antenna structure may exceed the 20 feet in height above the ground, natural formation, or man-made structure on which it is mounted. The Commission is obligated to prevent any radio transmitting antenna from being a hazard to aircraft, and whereas the transmitting antennas of other authorized stations have been cleared by the Commission as not constituting air hazards, the same is not true of receiving antennas.

Ben F. Waple, Secretary
Federal Communications Commission
Washington, D.C.

His Vacation-on-Wheels

My family Motor Coach sleeps six and is completely self-contained. It's a 1941 GMC

Yellow Coach with a GMC 308-cu.-in. 87.5-hp. engine. It gets 10 m.p.g. on the highway, eight in town. Between trips, the Coach is used as a guest apartment. Parking in a town is no problem as parking lots and side streets are usually handy and convenient for shopping.

I haven't noticed wind wander with this Coach, but then we only have gusty winds to 75 m.p.h. here on the desert!

These Motor Coaches are becoming ever more popular. For a handy person who has the inclination for one, an old bus and a few tools can add up to a useful and enjoyable vehicle.

Hugh Chase, Ridgecrest, Calif.

Backing Up the Warren Report

I read Mr. Melkonian's criticism of the Warren Report ["PS Readers Talk Back," June] and believe a test I made may explain why the President didn't pitch forward when hit. Shooting at a two-by-four at 100 yards, with a gun similar to the assassin's, I found the two-by-four was not thrown violently, as one might expect, but appeared to "float" over when hit. The bullet is of such velocity that it goes through, making a clean hole. At first I thought I had merely nicked the wood, but examination showed a neat hole.

Ronald Graham, Daytona Beach.

New Tricks for an Old Dog?

The trouble with the automatic choke on the '56 Mercury ["Say Smokey," May] may be caused by a burned-through heat tube. This tube fits across the manifold and supplies heated air to the choke. If it gets a hole in it, raw exhaust gas is fed directly into the choke, causing carbon deposits and drops of condensation, which freeze and keep the choke from moving. I had a great deal of trouble with

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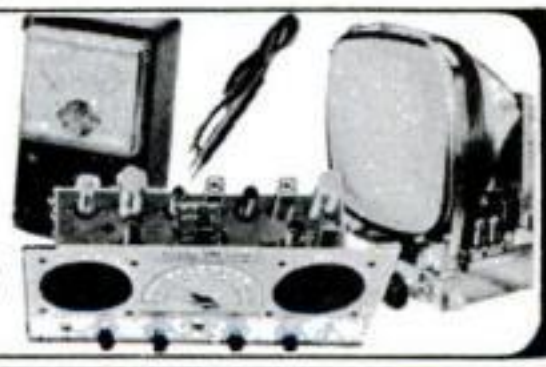

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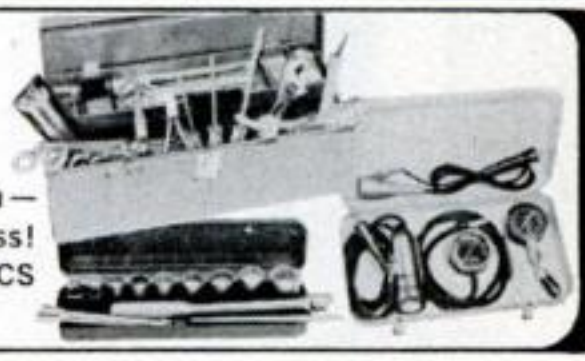

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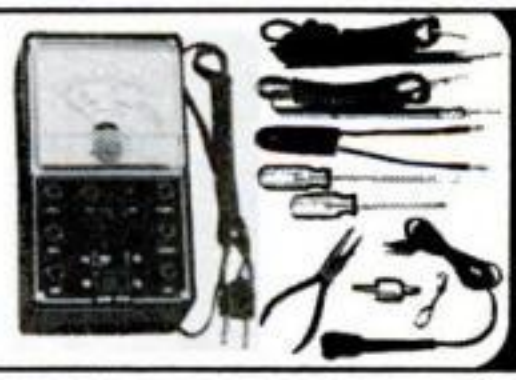

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my '57 Ford until I replaced the heat tube. Now the choke has gone two years without being touched.

C. W. AZNOE, Chana, Ill.

. . . Just read Smokey's advice [June] to the fellow who complains of a bad shimmy in his '60 Impala. I have the same car (except for Positraction) and had the same complaint. I balanced the wheels and had the front end aligned. No good. Then an old-timer told me to put new shocks on the front. Presto!—no shimmy.

JOHN N. OSVAI, Trenton, N.J.

The Pickups

Congratulations on recognizing America's most sensible utility vehicle ["Suddenly Pickup Trucks Are In," June]. One vital point:

The "overall superiority of independent front suspension" has *not* been proved in truck operations. Even pickups intended for light duty run into more severe conditions than the average passenger car. Experience in New Mexico points to the conclusion that beam axles hold alignment better and give longer tire life.

DAVID GILMER, Las Cruces, N.M.

. . . I'd like to know how you could expect to get as good a ride in a Ford F-250 with truck tires as you would in a Chevy C-10 with passenger-car tires?

GEORGE RENTSCHLER, St. Olaf, Iowa.

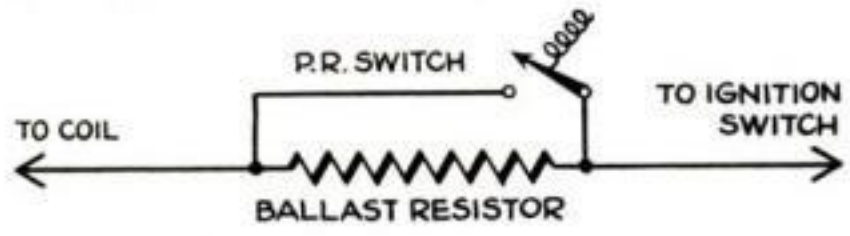
. . . I'm sure the people at GMC will be surprised to hear that they specialize in diesel-engine pickups. Until Jan Norbye mentioned it, neither they nor anybody else was aware of it. Also: Temperature and oil-pressure gauges are optional at extra cost on the Chevy.

THEODORE HOADLEY, Mansfield, Ohio.

A Money-Saving Switch

In the June "Hints From the Model Garage" you suggest using a double-pole, single-throw switch to aid in starting a Rambler, and a pilot lamp to remind you to switch it off.

Why not save the cost of the lamp and its mount, and be sure the switch is off when it is supposed to be? This can be done by connecting a single-pole, single-throw, positive



return to the off-position switch across the ballast resistor. This can be used on any car regardless of where the ballast resistor is connected to the other components of the circuit.

To use, pull positive-return switch when starter switch is used.

WILLIAM O. KINGSTON, Kensington, Md.

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NRI's special new section on modern air conditioning and refrigeration gives you complete know-how in this fast-growing field. Other sections are invaluable for men who work on farms, or in stores or plants. No matter what you're called on to fix, in no time you'll be making repairs like a pro. And — you now get special bonus lessons on 2- and 4-cycle gasoline engines!

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More than a MILLION appliances and engine-powered tools are sold *each week!* Once you can fix them, you'll "cash in" on this boom. It's a fact: NRI-trained men earn $3.00 to $5.00 an hour *in spare time alone!*

Don't worry how little you may *now* know about repair work. Former student John D. Pettis, who works out of his basement, says: "I had practically no knowledge of any kind of repair work. Now I am busy almost all my spare time and my day off — and have more and more repair work coming in all along."

No matter where you live, everyone owns and *depends on* appliances. And once you know how to service them, the owners depend on YOU!

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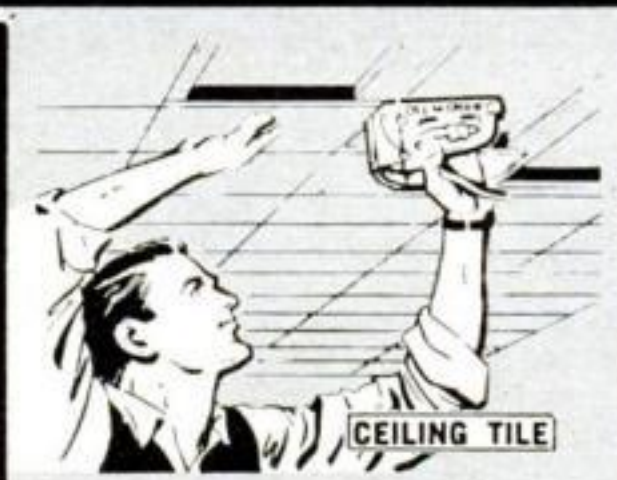

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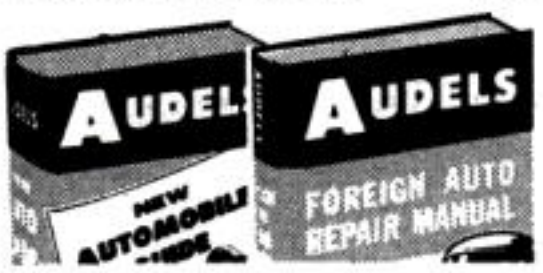

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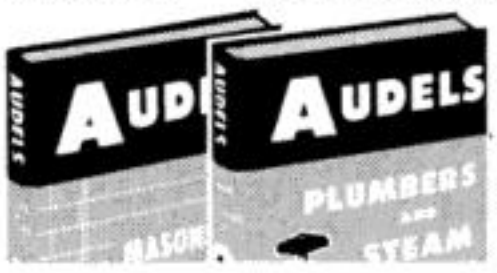

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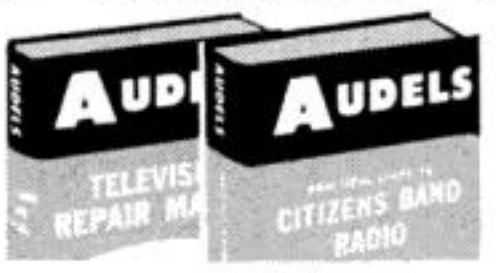

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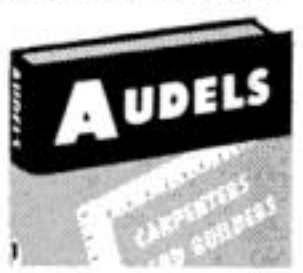

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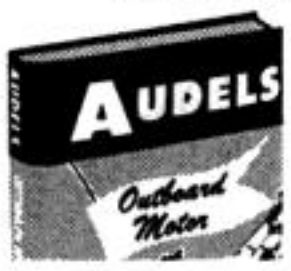

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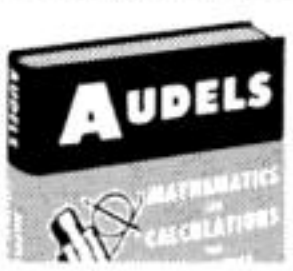

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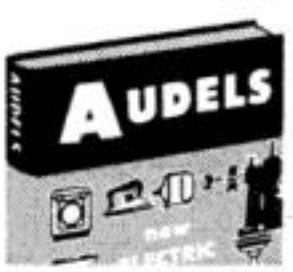

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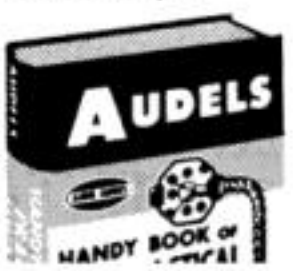

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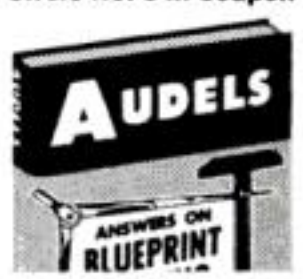

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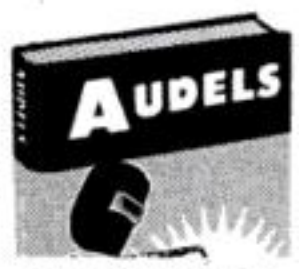

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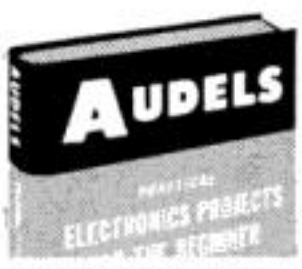

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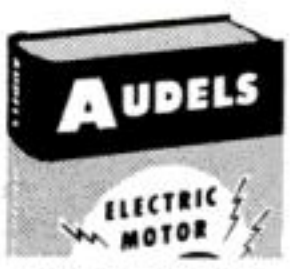

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The rocker arms and shafts are lubed through the cam bearings, and these bearings in your right bank are still plugged. Get the cam pulled out of there and have those passages really opened up and the sludge cleaned out. While at it, make certain the cam bearings are not excessively worn, button it back up, and the oil will circulate correctly.

►***"Gasoline keeps getting into the crankcase of my '63 VW. During the winter I often have to change oil every 50 miles because of this. The more the local dealer works on it, the worse it gets. Now he says there's nothing more he can do except install an 'electromagnetic pilot jet' for $10, which might remedy it. Do you think that might help?"—Leo Gall, Moorehead, Minn.***

I don't think the jet is the best answer. VW has a new part out called a "fuel-line valve" that works fine in their '65 models, and should cure your problems. The part number is 113 127 405. It costs $6.05 and could be installed for about $1.25.

►***"My '60 Plymouth has squealing rear brakes. Linings were replaced twice. The drums were turned the second time. I tried two other sets of linings, and installed dampener springs on the drums. It does not help. What's your remedy?"—Richard DesJardin, St. Petersburg, Fla.***

First, check that the backing plates are not bent. Don't try to use drums that have over 0.050" turned off them. Get premium linings such as Chrysler's MoPar for that model car. Just turning the drums isn't enough. If they still squeal after turning, have them honed until they're extremely smooth. Change your brake springs–retraction and backing plate, also. Make sure your brakes are then adjusted by the book, and I'll bet your squeal will be gone.

►***"When I set the timing on my '62 GMC pickup with a 305-B mill, the vacuum-control advance throws it off. I installed a new unit—no difference. Blocked it off, and the timing works fine. Is blocking off***

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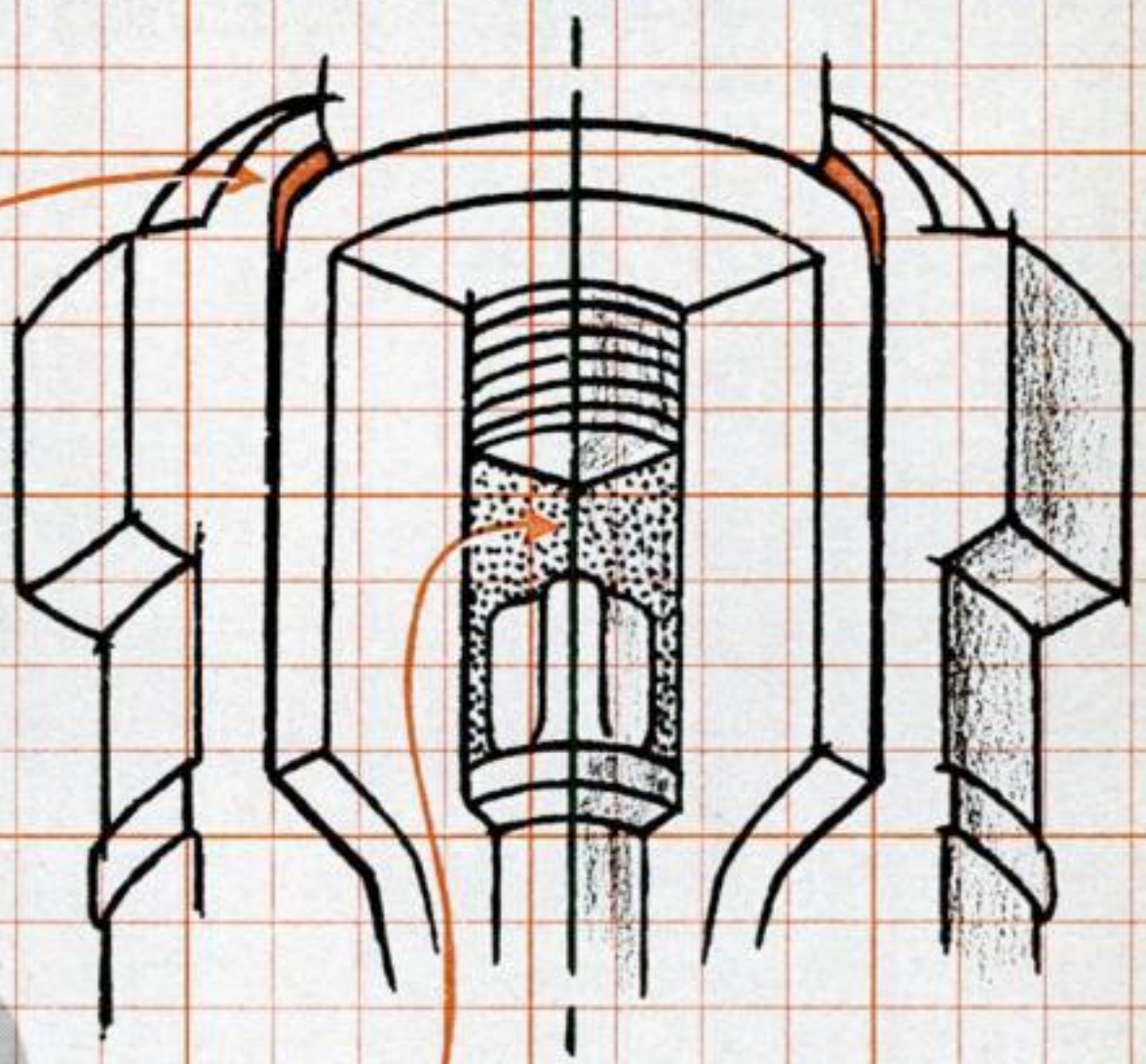

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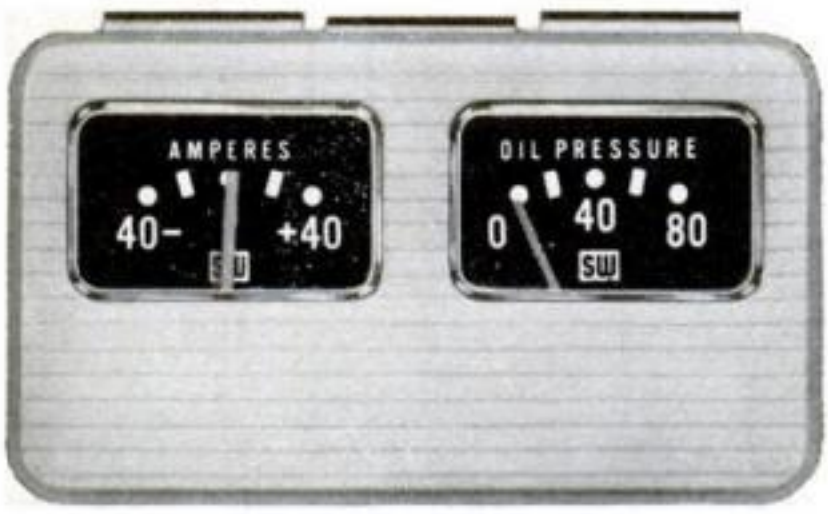

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Smokey Yunick continued

okay, or is there a way to make the unit work?"—W. L. De Mars, Seattle, Wash.

Use the GMC specs shown in their service manual for this model. That gives the correct method to set the static advance, which actually starts around 450 to 500 r.p.m. You should remove the vacuum lines to set the static advance. Then hook her back up and check out the top end of the distributor curve. For a final check, using your regular fuel, take it on the highway, and you can then advance or retard the timing until the spark rattle is gone.

►***"Our '58 Olds was wrecked in an accident. From what I was told, a seat belt saved my life. I now have a '60 Olds in which I want to install belts. The trouble is that I can bolt them through the floor, but the seat is solid and I can't get the belts through it. I'd appreciate your suggestions, since I don't feel safe riding around without them any more."—G. Belin, Russell, Pa.***

I'm with you about needing seat belts. Remove the front seat and have an upholsterer cut and bind openings for the belts to fit through. It's some trouble, but I'll bet you, with your experience, would be the one to say it's worth it!

►***"My '59 Dodge V-8 overheats. The radiator has been flushed and flow-tested to specs. Soft plugs were removed, the block cleaned, and new hoses installed. A new thermostat was checked for the proper opening, and a new plastic impeller put on the water pump. The engine has a six-bladed fan, and a new pressure cap tests 14 pounds. The system loses no water even when pressurized to 15 pounds. Also, there is no water in the oil. What next?"—A. L. McGee, Wakefield, Kan.***

Remove the radiator, have the tank removed, and the core rodded out. A flush job won't help a truly plugged radiator. Make sure the hose on the suction side of the pump is not collapsing under suction. Since it wasn't mentioned, I assume you have checked that the timing and advance mechanism in the distributor are okay—late timing can cause much heat. So can a late camshaft. Next, remove the thermostat with a block full of water on a cold engine, crank it up, and lug it—by slipping

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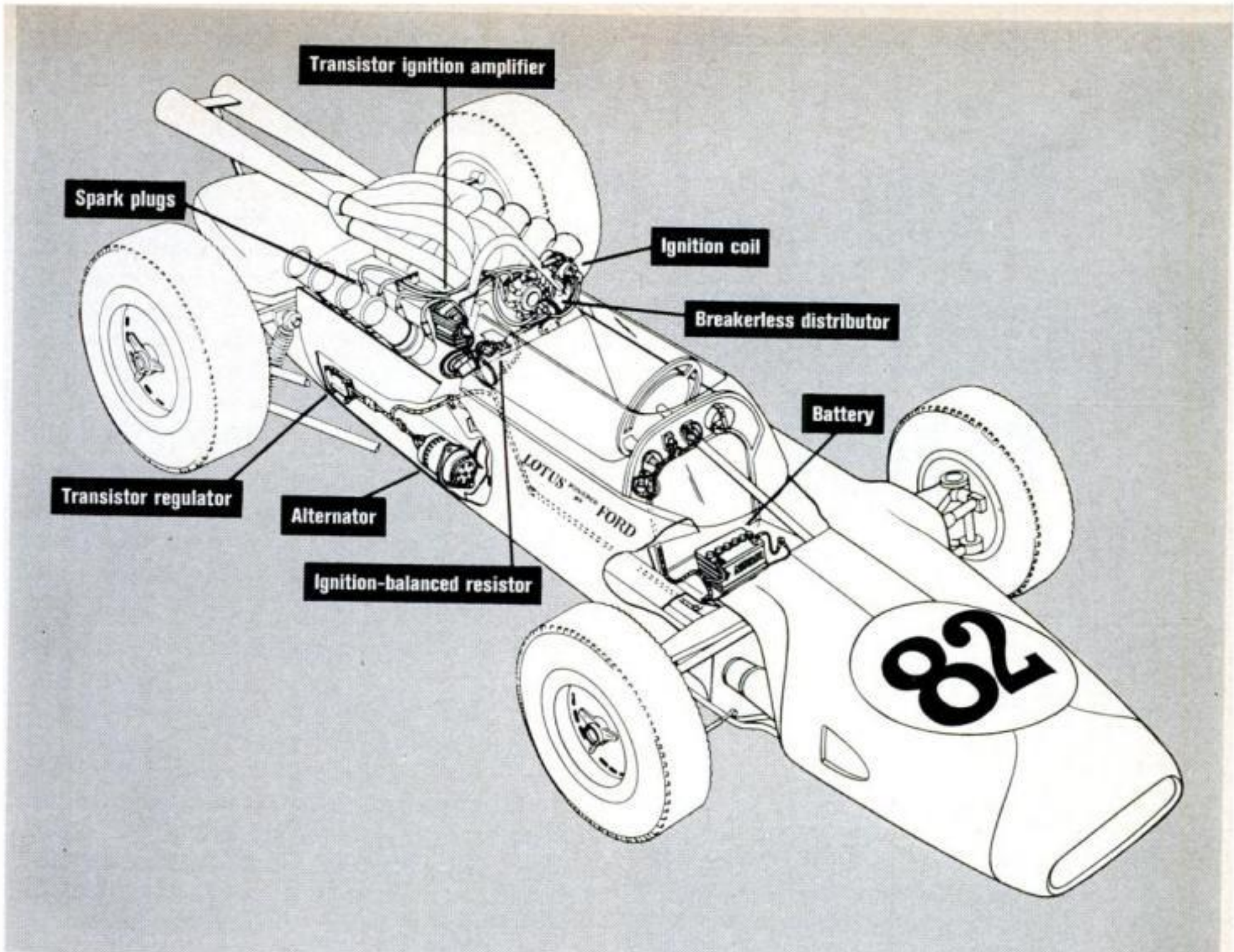

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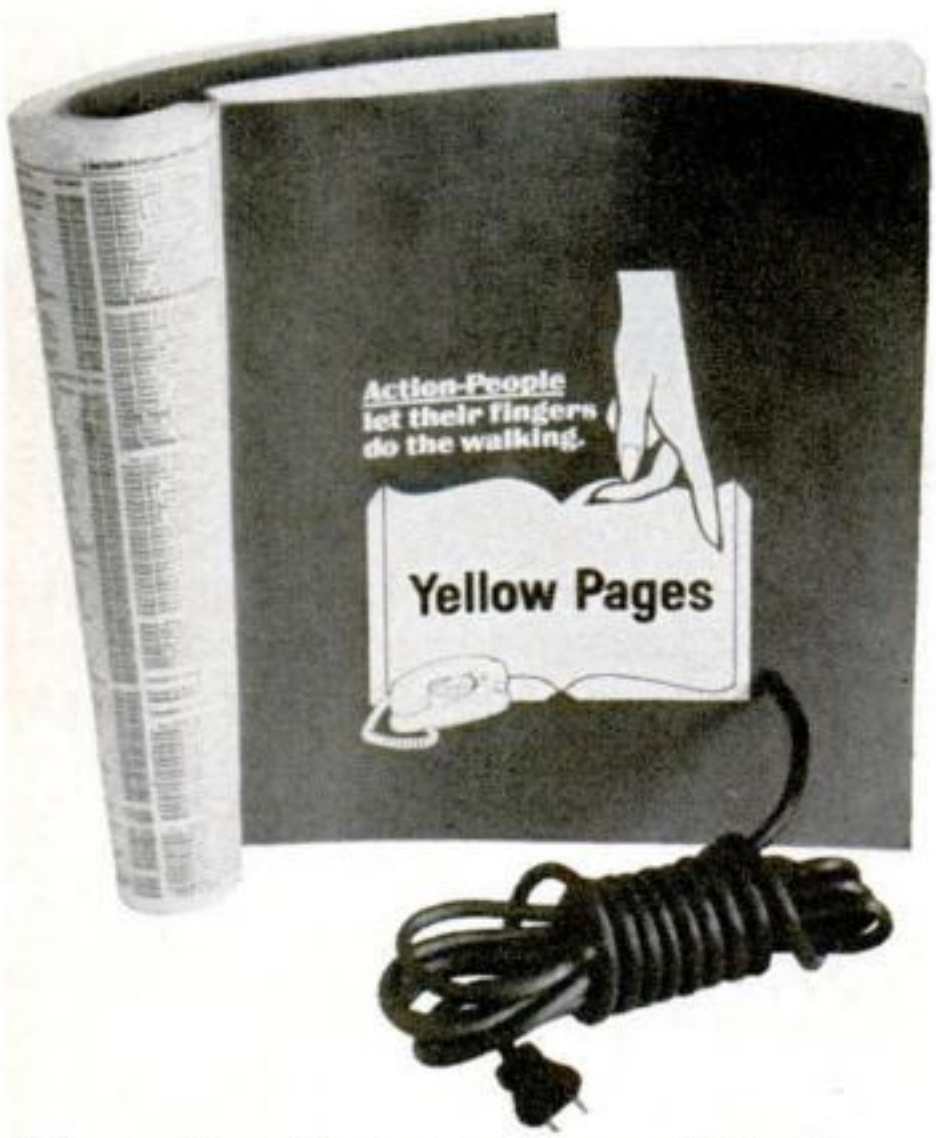

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Smokey Yunick continued

the clutch or running in gear with the emergency brake on. Look for bubbles at the water outlet. They would indicate a leak. Also, check what the factory specifies as the amount this cooling system holds. Drain the water from yours and check the amount. If you aren't carrying enough water, you may have an undersized radiator, or air pockets somewhere in the system that steal water space. You may have to bleed the engine somewhere near the back end of it.

►***"We've had to put in new coils three times in six months on our new '65 Chevy V-8. What could keep making them burn out?"—William E. Roll, Milford, Ohio.***

The coil in that car should actually be good for five or more years. Check for loose wires, too high or too low voltage, or incorrect wiring, such as the wrong polarity. Also, check the distributor-cap rotor, the plugs and coil wires to be sure they are the correct type and are assembled right. Check the condenser, too. If you have installed any supergadgets in your ignition system, put them in the glove compartment. With this ignition system right, the coils won't need changing any more.

►***"What are the ratios of the four-speed transmission and rear end in my 1965 Chevy Super Sport with 325 hp.? What are the valve setting, point dwell, and distributor setting? I read that this car would come with transistor ignition, but it didn't. Is this only optional?"—Barry Ramsay, Cambridge, Ohio.***

You don't state which four-speed you have. One is: 2.56 in first, 1.91 second, 1.48 third, 1:1 high. The other is 2.22, 1.64, 1.80, and 1:1. The rear end on both is 3.3:1. Valve settings are: .020 intake, and exhaust the same, both hot. Cam angle on the distributor is 28 to 32 degrees. Total spark advance is 38 degrees at 4,400. Transistor ignition is optional on that model of Chevrolet.

. . . . . .

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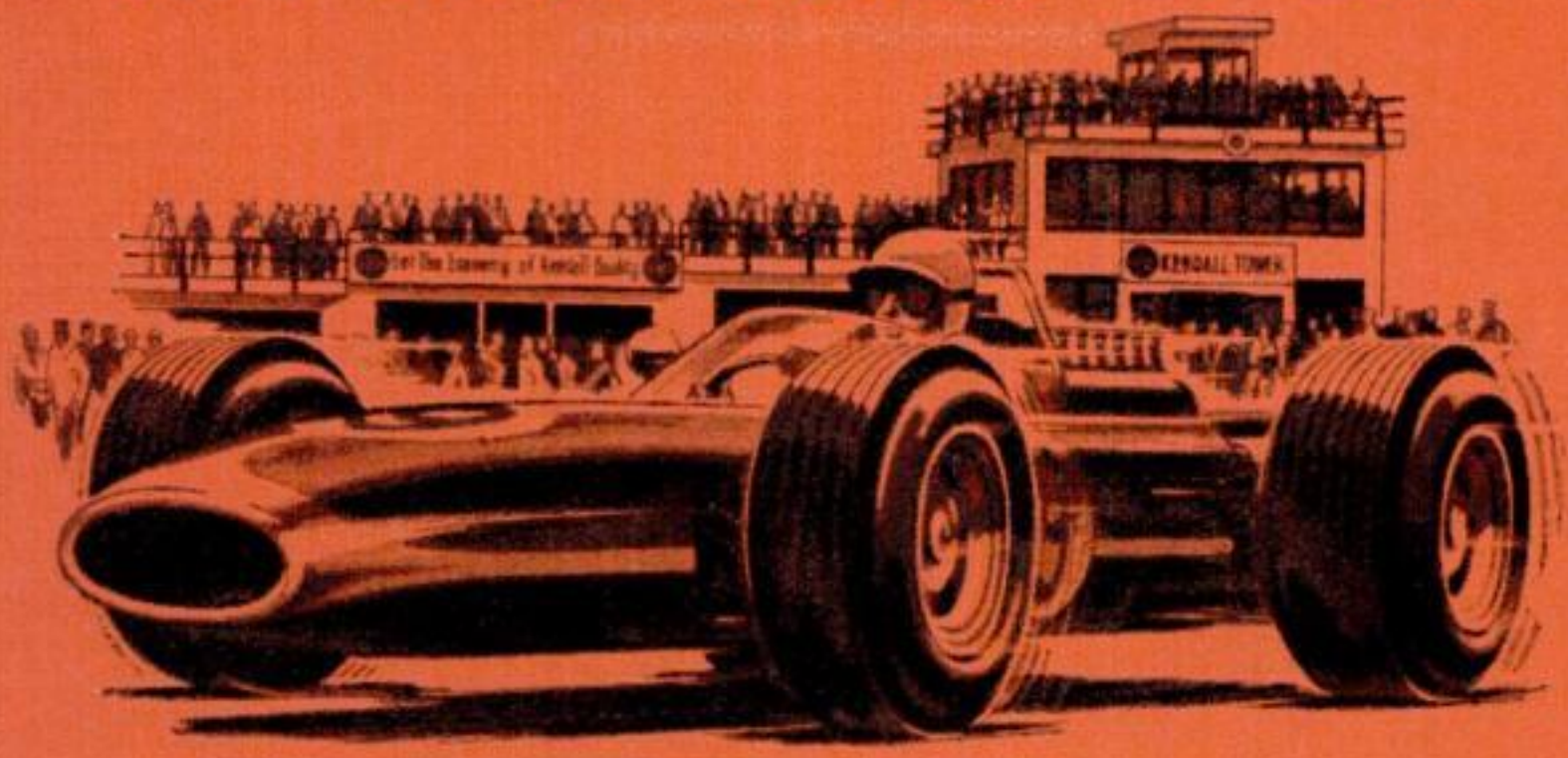

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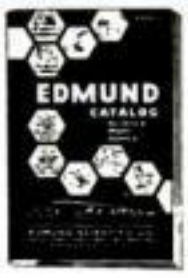

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SCIENCE *Newsfront*

BY WALLACE CLOUD, PS SCIENCE EDITOR

Tiny computer translates Morse code for GIs

Latest in the long line of devices the size of a cigarette package, this electronic translator listens to Morse code picked up by a GI's backpack radio, then blinks out letters and numbers in lights.

The idea is to permit men without special training to read messages sent in dots and dashes. The code can get through when distance, interference, or rugged terrain makes voice radio unintelligible.

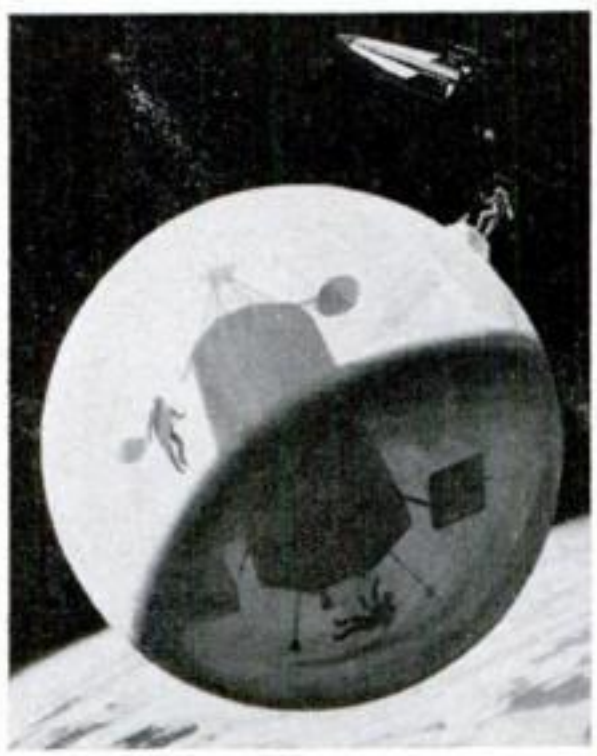
Developed for the Army by Regency Electronics of Indianapolis, the translator uses microcircuitry including 350 diodes and 75 transistors to recognize the sequence of dots and dashes, identify the spaces between characters, and switch on the right pattern from 17 tiny light bulbs. It's powered by rechargeable penlight batteries.

The gadget may be the forerunner of pocket computers that will eventually help you straighten out the household budget, figure your income tax, or work out handicaps for the horses.

Plastic-bag idea: prevent lost space-walkers

It's a wonder that a space-walker manages to have any fun, sealed into several space suits and covered all over with hoses, valves, biomedical sensors, microphones, switches, and oxygen tanks. Now they want to take away one of the few joys left in his life—the view. This may happen when space-walkers become space-workers, assembling and repairing satellites in orbit.

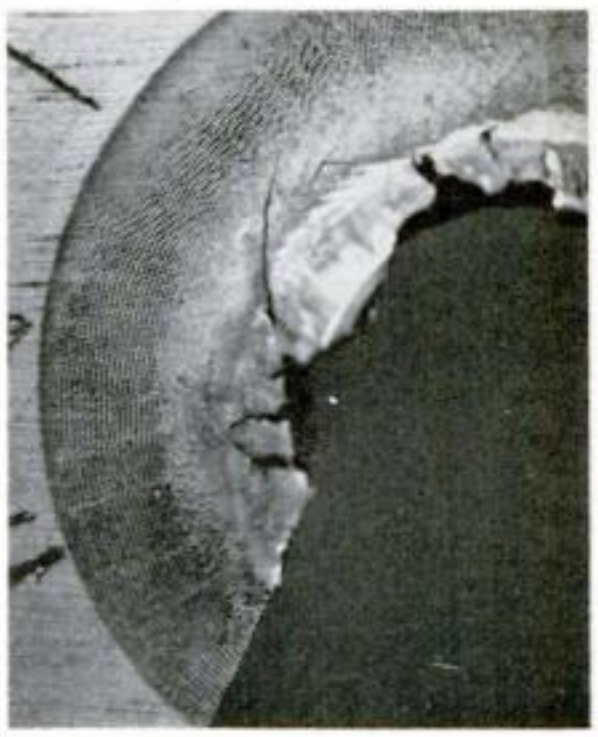
A report prepared for the National Academy of Sciences recommends enclosing space-walkers and their job in a translucent balloon. After entering through an airlock, astronauts would be untethered, with no worry about



floating away or dropping tools. But how do you get that big satellite in a balloon?

Ripples in metal record impact at 10,000 m.p.h.

What happens to an aluminum plate hit by a projectile moving at over 10,000 m.p.h.? The projectile makes a hole, of course, as this unusual photo shows; but around the hole are ripples like those made by wind on water or a



sandy beach. Engineers at Technical Operations Research, Burlington, Mass., say this is because the solid metal acts like a fluid under high-speed impact. The electrical "guns" they've designed fire paper-thin disks of plastic, ¼-inch in diameter, at velocities up to 26,250 m.p.h. to simulate micrometeoroids in space.

How to drive between the raindrops

Windshield wipers are all right, but they wear out, and in a cloudburst they just give up. It's even worse for the pilot who has to make a landing in a downpour. Could there be something better—a repellent that would keep water off the windshield?

Chemist D. F. Stedman of Canada's National Research Council thought so 24 years ago, and he's been working on the problem ever since.

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Science newsfront continued

After many versions of the repellent that were more or less successful, Dr. Stedman came up with one that satisfies him completely, and he has now applied for a patent.

The rain repellent, a complex silicon compound, looks like black shoe polish. When it's applied and rubbed briskly, its molecules are decomposed by friction and the broken molecules combine with the glass to become part of its surface in a layer one ten-millionth of an inch thick. In tests, the repellent has lasted several months, but biweekly application is recommended.

Water hitting the treated glass doesn't spread and stream—instead, it jumps right off. On an aircraft windshield, even the heaviest rain looks like grains of pepper striking the glass and being blown away. The wind across an automobile windshield doesn't move as fast, but the water jumps off the glass in little jets; there's safe vision at any speed, and wipers make things crystal clear.

Evolution of Italian cooking: Roman aristocrats were guinea pigs

Lead poisoning was responsible for the fall of Rome, according to a California toxicologist, Dr. S. C. Gilfillan. The use of lead-lined cooking and wine-making vessels, along with lead paints and cosmetics based on lead, he thinks, caused the Roman aristocracy to die out rapidly.

The effects of small amounts of lead continually taken into the system are insidious: death at an early age, sterility, a high rate of miscarriage and stillbirth. Dr. Gilfillan says life expectancy in the educated and wealthy classes of ancient Rome was only 22 to 25 years, and that three-quarters of the aristocracy was eliminated in each generation.

The process began in the second or first century B.C., after the introduction of lead-lined kitchenware from Greece, along with Greek methods of food preparation and wine making. Lead may have had a similar effect on Greece a few hundred years earlier.

The poor people of Rome escaped poisoning, according to this theory, since they had less of the luxury foods that were most contaminated with lead—wine, syrup, olive oil, and drinks made from fruit or honey—and less cosmetics and lead paint.

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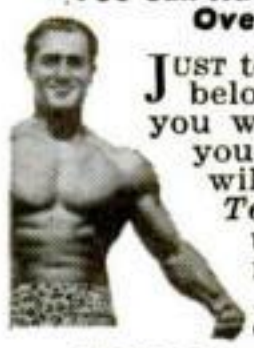

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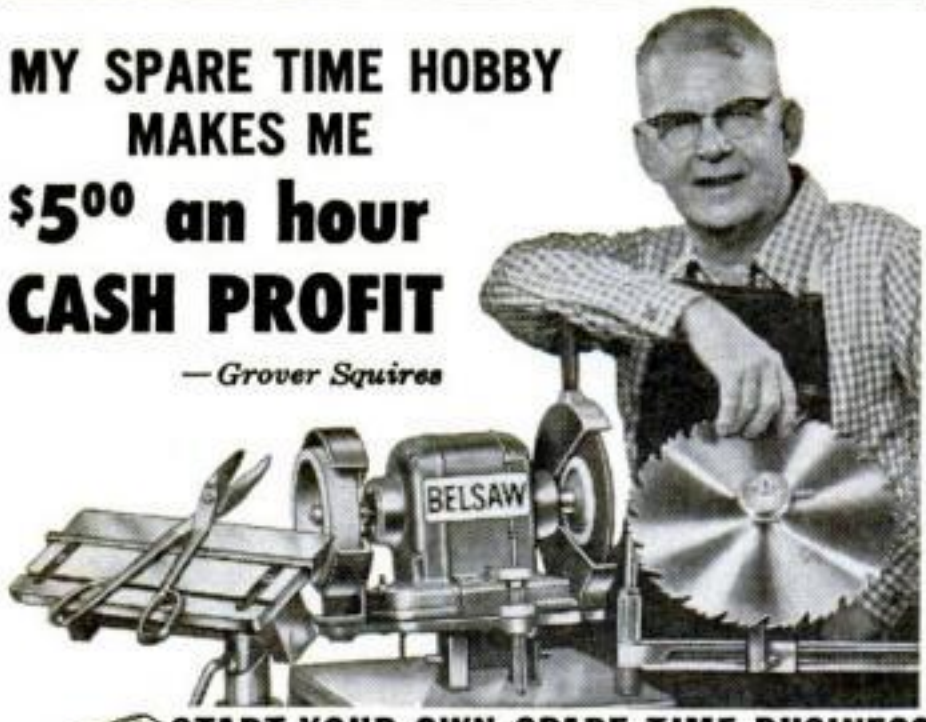

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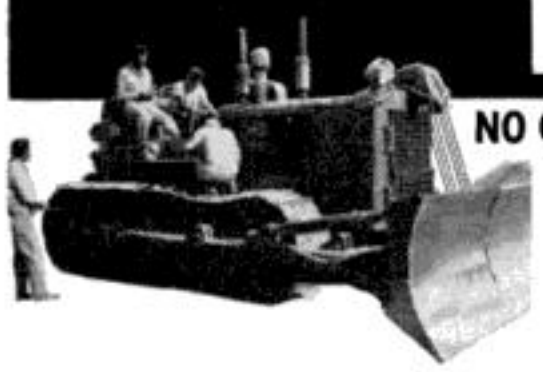

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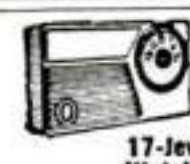

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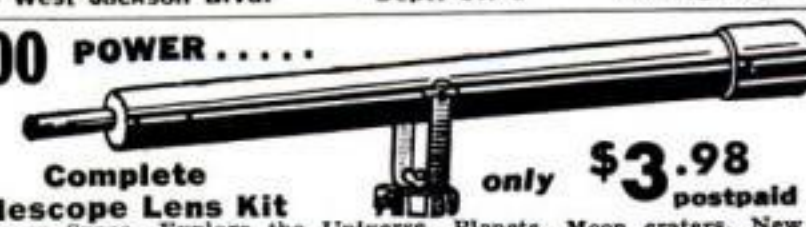

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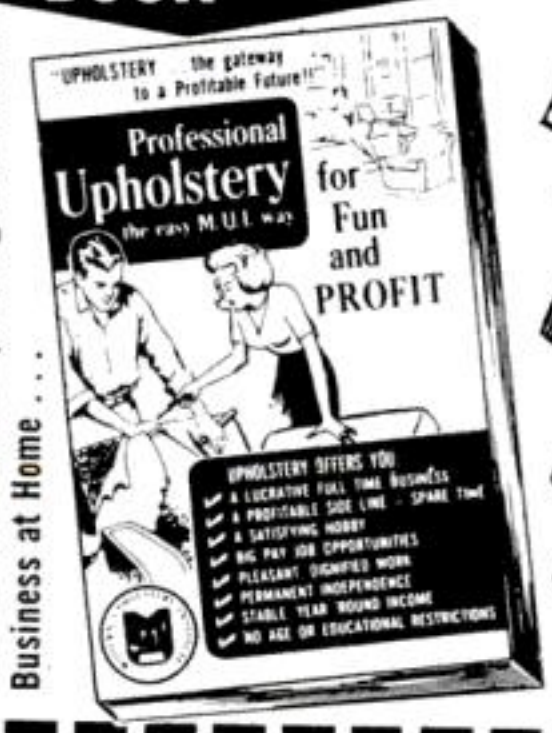
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Detroit report...

THAT NEW PONTIAC SPORTS CAR will probably be a two-seater. To avoid a head-on clash with Chevrolet's Corvette, it will be smaller (about the size of a Mercedes 230SL) and less expensive. Two body types are planned--coupe and convertible--in a sleek, new style that retains only the most essential notes of family resemblance to the Tempest and the full-size Pontiacs.

At least six safety features required on cars sold to the U.S. Government will be standard equipment on all domestically manufactured cars for '66: rear seat belts, padded instrument panels, backup lights, outside mirror, two-speed wipers and washers, and padded visors.

The 17 safety requirements of the General Services Administration were received by the auto industry, on the whole, with considerable relief. These requirements apply to the 60,000 cars the GSA expects to buy in 1967, and most auto makers will research, develop, and standardize them during the 1966 model year.

Smog-control devices and steering columns that won't push into the passenger compartment more than five inches in a head-on crash at 20 m.p.h. are two major GSA requirements. Both involve engineering headaches, as cost is a critical factor. Smog-control devices (standard for California in 1966) will add between $15 and $65 to the price of a car. The 15 less drastic safety stipulations call for:

Stronger seat-belt anchorage points
Padded dash and sun visors
Recessed knobs and levers
Safety door locks and hinges
Stronger seat anchorages
Safety glass in windshields and windows
Four-way flashers (as standard in N.Y. in 1966)
Twin master-cylinder braking systems
Standardized bumper height
Standardized shift patterns (P-R-N-D-L)
Two-speed wipers and windshield washers
Antiglare dashboard finish
Safety tires and rims
Backup lights
Side mirrors

The next big step in auto safety must come from federal or state legislative bodies, not from the industry. But that will take time; politicians are afraid to champion causes that might cost votes. But laws are needed to bar defective vehicles from the roads and to enforce a modern system of driver education and licensing.

Ford of England has a new range of V-4 and V-6 engines under development. A new Ford Anglia will be introduced this fall—a round-shaped little sedan. GM's German subsidiary, Opel, will bring out a restyled Kadett (something like a baby Chevelle), and the Rekord will get a new single-OHC engine. VW denies the existence of a new beetle, but a 1.3-liter engine is imminent. BMW will launch its 1300. Mercedes-Benz will drop the 190 and 220 series in favor of new and larger cars: the 200 and 250. Standard-Triumph is readying a front-drive sedan with a transverse 1.6-liter engine. And Auto-Union (DKW) will finally get a four-cycle four for its front-drive F-107.

Chrysler will take a firmer hand in the management of its European interests (Simca and Rootes). Don't be surprised if a Simca-engined Hillman Minx appears, followed by a Humber Imperial with a Chrysler V-8. The next step should be Valiant assembly in Britain. (Don't forget; Renault has been assembling Ramblers in Belgium for two years now.)

Tinted windshields cut drivers' vision, according to the American Academy of Optometry. Drs. Merrill J. Allen and John K. Crosley report a 75-percent loss of night visibility with full-strength liquid tint used on all glass. There ought to be a law, they say, against tinting. Sunglasses (removable at night) do a better job of easing eyestrain, they advise.

Jan P Norbye
Automotive Editor

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Call in your family or friends. Ask them to make a list of any TWELVE facts, names or objects they wish, as fast as they wish. Have them write down the list so they won't forget it! **But, as they give you each fact, YOU are going to perform a simple mental trick on that fact, that will burn it into your mind, IN PERFECT ORDER, as long as you wish!**

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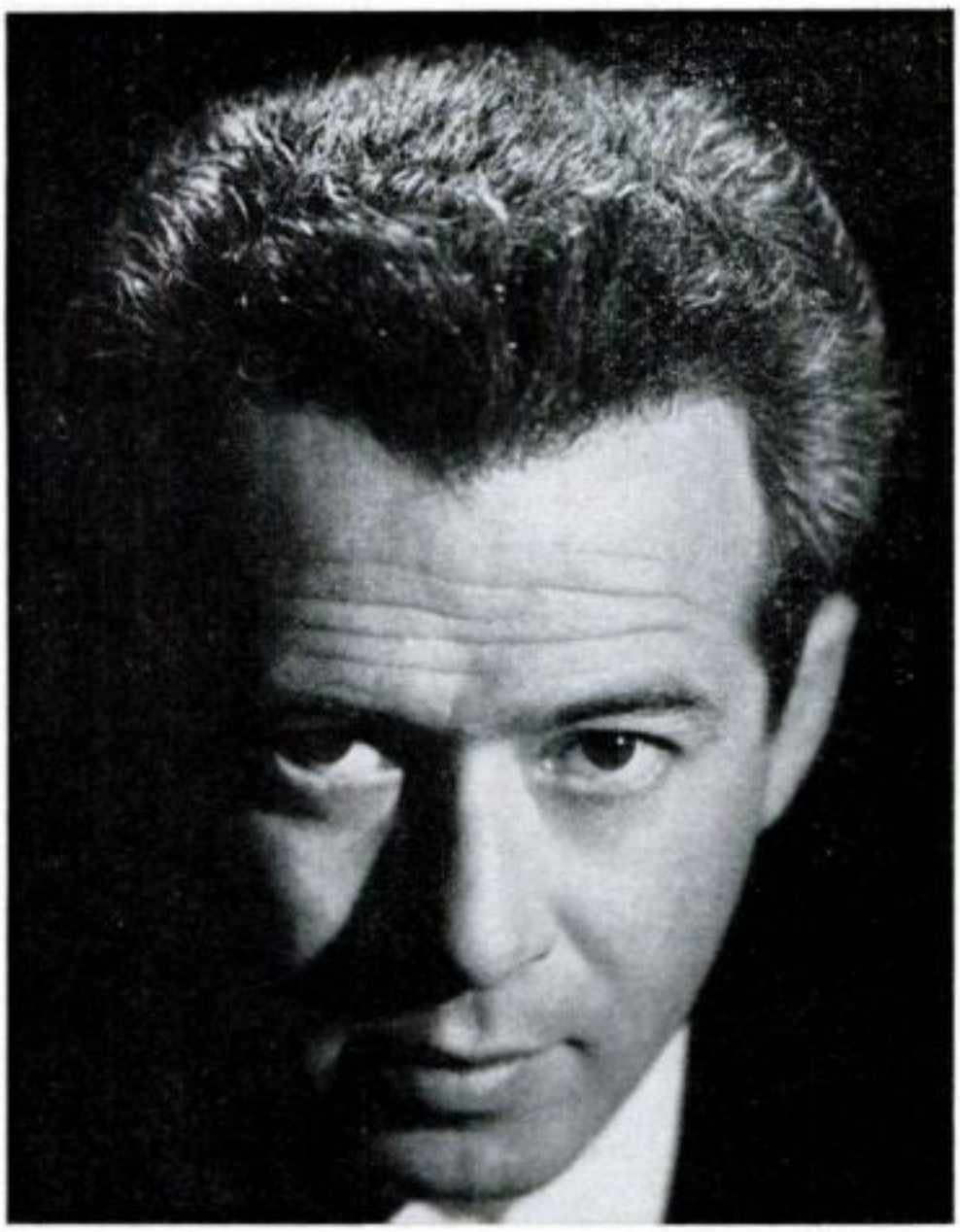

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Popular Science Article on Atomic Industry Draws Strong Protests

An article by PS Science Editor Wallace Cloud in the June issue ["Is Atomic Industry Risking Your Life?"] has elicited vigorous protests from several spokesmen for that industry. The consensus of these objections is that we exaggerated the hazards of the rapidly expanding nuclear industry in the United States.

In the interests of fairness to all segments of opinion on a subject of serious concern to all of us, we quote below some of the strongest criticisms of the article:

I was astounded and appalled to read in your publication the inaccurate and dangerously misleading "scare" story on the atomic industry . . .

From the fictional first-page illustration that shows what appears to be a commercial power plant irradiating neighboring homes (which has never happened and will not happen), to the text which carefully avoids presenting the facts about the remarkable safety record of the atomic industry, the article is the most misleading thing I have seen written about atomic power . . .

Power reactors are safe. There has not been a single fatality in connection with a commercial atomic power plant or commercial reactor . . .

Power reactors are *not* "still largely experimental" as your writer claims. There *are* "completely workable designs." The pressurized water reactor which Westinghouse builds, for example, has been proved during more than a dozen years of operating experience and many generations of plants . . .

There are so many other misstatements in this amazing article that I can't go into them all. The clumsy attempt to make the operation of a reactor sound the same as the operation of a bomb is a typical example . . . Because the principle of fission is employed in both cases does not make them the same. To say so would be like saying the principle of combustion makes the Chicago fire the same as the engine in your automobile . . .

J. W. Simpson
Group Vice President
Westinghouse Electric Corp.
Pittsburgh, Pa.

. . . An uninformed member of the public reading the article by Mr. Cloud would very quickly assume that this was a terribly dangerous industry, not very well regulated. Admittedly, the potential danger is great. But, so is it from many other activities in our industrial society . . .

Considering the casualness with which our magazines and newspapers accept the terrible slaughter on our highways and the loss of life in industry as a whole, I fail to appreciate the dramatization of the death of one man in a Rhode Island uranium scrap recovery plant . . .

R. G. McAllister, Radiation Hygienist
Liberty Mutual Insurance Companies
Hopkinton, Mass.

. . . The nuclear industry in the United States has a truly remarkable safety record, especially in privately operated facilities. Almost incredible extremes of caution are used, because of the relative newness of the industry and because of the kind of risks that could be imagined . . .

David L. Hetrick, Professor
Department of Nuclear Engineering
University of Arizona
Tucson, Ariz.

It is difficult for me to understand the purpose behind your article . . . because everyone working to perfect this new type of electric generation is doing everything in their power to build and operate these plants in a safe manner . . . We think atomic power is here to stay . . .

R. D. Furber, Vice President
Northern States Power Co.
Minneapolis, Minn.

I was very much interested in this article and . . . I find that it has created quite a bit of interest in technical groups. However, my associates who are with me in the nuclear field are very pleased with the safety record to date and are not particularly concerned with the possibility of a poor record in the field of radiation safety in the years to come.

The general public, however, seem to be paralyzed with fear in connection with anything in the nuclear area, probably because they don't understand this type of radiation and because of the many articles in newspapers and magazines that have made them fear it. It would seem to me that your article is a good one, but overemphasizes the hazard . . .

Myron A. Snell
Supervisor of Technical Services
The Hartford Insurance Group
Hartford, Conn.

. . . I can only say I am astonished that any supposedly reputable publication would publish such an erroneous, biased, and misleading article. While this type of sensational journalism may be "popular," it certainly isn't "science" and one would hope it won't be "monthly"!

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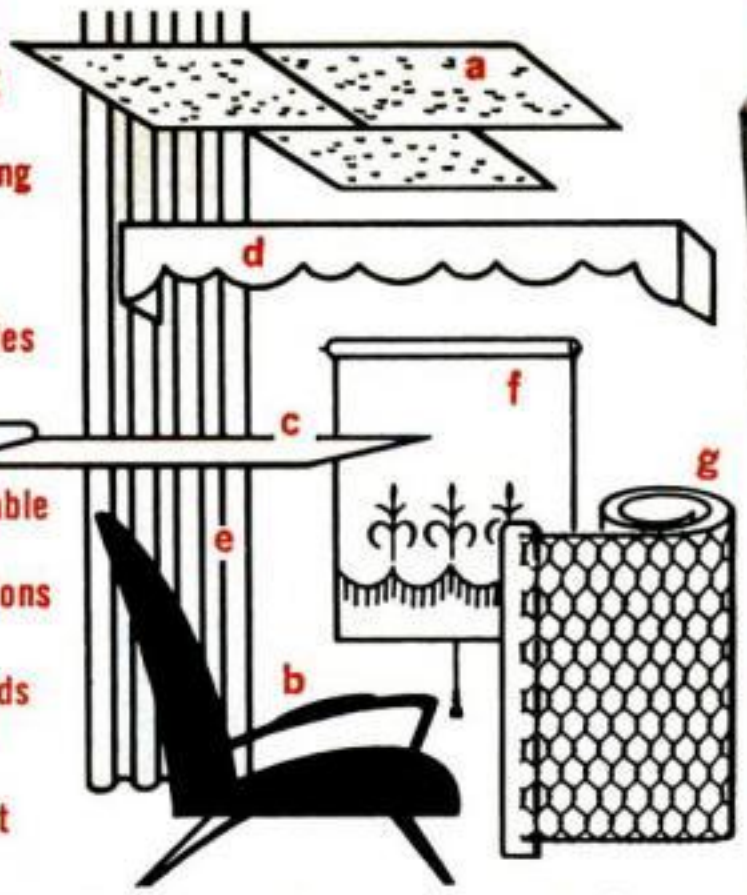

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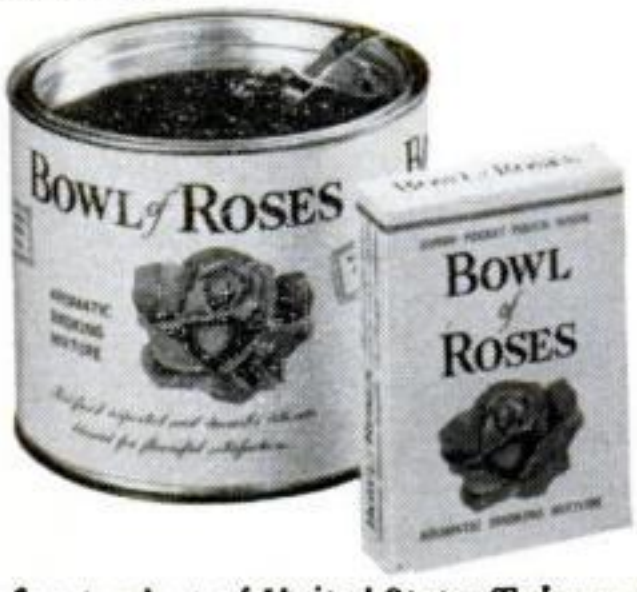

Another fine product of United States Tobacco Company

Since I am President of the Atomic Industrial Forum I not only have a strong feeling about this matter but also know the writer was provided with a large amount of factual information both by the Forum and the Atomic Energy Commission. Mr. Cloud apparently chose to ignore this information in order to have a more spectacular and salable article . . .

W. KENNETH DAVIS, Vice President
Bechtel Corp.
San Francisco

The map of the atomic industry which you have included in Mr. Cloud's article . . . is very impressive and succeeds in visually portraying the extent to which the industry has grown over the past 20 years . . . The article itself left me feeling a bit uncomfortable; not so much from what Mr. Cloud wrote, but from the way in which it was written . . .

JAMES C. EVANS, General Manager
Western New York Nuclear
Research Center, Inc.
Buffalo, N.Y.

. . . Although technically correct in most aspects, Mr. Cloud has emphasized, dramatized, and highlighted hypothetical hazards of atomic power and omitted or de-emphasized its benefits to a degree that presents a badly distorted picture . . .

ROBERT H. DUNLAP, Director
Florida Nuclear & Space Commission
Tallahassee, Fla.

. . . The lack of a positive, assuring statement to alleviate the public's fears is certainly a shortcoming of the article. Use of the following terms "*Normally*, steps are taken to prevent accidental criticality," "Control . . . is *usually* good," "Perhaps, however, the growth of the industry is increasing the probability of atomic accidents," is bound to create public apprehension of the safety of nuclear reactors.

G. HOVORKA, Director
Nuclear Services
Commonwealth Associates, Inc.
Jackson, Mich.

. . . I particularly disliked the alarming scare-headlines used in your June issue. There is nothing particularly incorrect about your facts, but you have adopted a style and manner of writing so often employed by our press to attain the attention of readers . . .

JERALD S. HANKS, Secretary and Treasurer
Industrial Reactor Laboratories, Inc.
Plainsboro, N.J.

. . . Mr. Cloud's article has no apparent usefulness except for a certain "scare" value. This may attract the attention of readers, but nothing in the article puts the subject in

CONTINUED

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Are you satisfied with your present job? Where are you headed? Perhaps you've done all right but want more out of life — you wish you could move forward. If so, now is a good time to consider getting into a high profit field as owner of a franchised MARTINIZING DRY CLEANING STORE. Get financial independence and security for your family. Enjoy the benefits of a pleasant lifetime business in the service field — a business which now numbers over 2,000 independently-owned stores from coast-to-coast in 16 years — and is still growing.

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A wonderful advantage of owning a Martinizing franchise is you don't have to quit your job. If you wish, you can have someone else manage your store. And when you retire you can move into a pleasant lifetime business, with a substantial income. In fact, Martinizing store owner incomes often far exceed executive salaries.

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Martinizing stores are suited to every type of community or location and are proven profit-makers. The initial cash requirement is about $10,000. If this sounds good to you — if you would like high income with security, send today for more details.

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2005 Ross Ave., Cincinnati, Ohio 45212

With no obligation mail me your illustrated "Key To Success" booklet that explains how I can achieve financial security with a One Hour Martinizing franchise.

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RIFLE SCOPES

proper perspective or suggests a useful solution, if there is a real problem. The piece reminds me of the articles on sex announced on the covers of countless newsstand magazines every month . . .

EDWARD J. MATSON
Director of Commercial Development
Abbott Laboratories
North Chicago, Ill.

. . . I do not dispute the facts presented, since they add up to a safety record unmatched by *any* other major industry in the country. I do take issue with the obvious intent by the writer to frighten the reader into believing that the industry is not exercising sufficient safety precautions . . .

MARK R. DUSBABEK
Nuclear Consultant
The Fluor Corporation, Ltd.
Los Angeles

. . . We must protest the most unscientific manner with which POPULAR SCIENCE MONTHLY deals with the question of radiation safety . . .

In no other industry have the potential hazards been so fully realized from the beginning and such stringent precautions taken to protect both workers in the industry and the general public. The outstanding safety record of the nuclear industry is ample proof that these measures have been successful.

Both the Commission and the industry recognize that this record is no cause for relaxation of our vigilance. I assure you we intend to continue our vigorous safety efforts both through our licensing program and through our AEC contractor program . . .

DUNCAN CLARK, Director
Division of Public Information
U.S. Atomic Energy Commission
Washington, D.C.

We are glad to publish the comments above; they reflect the opinions of men who know the field firsthand. Nevertheless, we maintain that our article was essentially factual, and presented a balanced appraisal of the hazards of nuclear power in its present stage of development. It should be noted that it included a number of references to the atomic industry's favorable safety record. For example, reference was made (page 46, June PS) to the fact that the atomic industry has a lower accident rate than most industries, and that no injuries to the public have occurred.

Never in 93 years of publication has Popular Science pursued a policy of sensationalism or irresponsible journalism. We believe that our first and strongest obligation is to the public—to present to our readers the facts as we see them after thorough and conscientious research. And to Mr. Clark's final paragraph, quoted above, we say Amen. ■■

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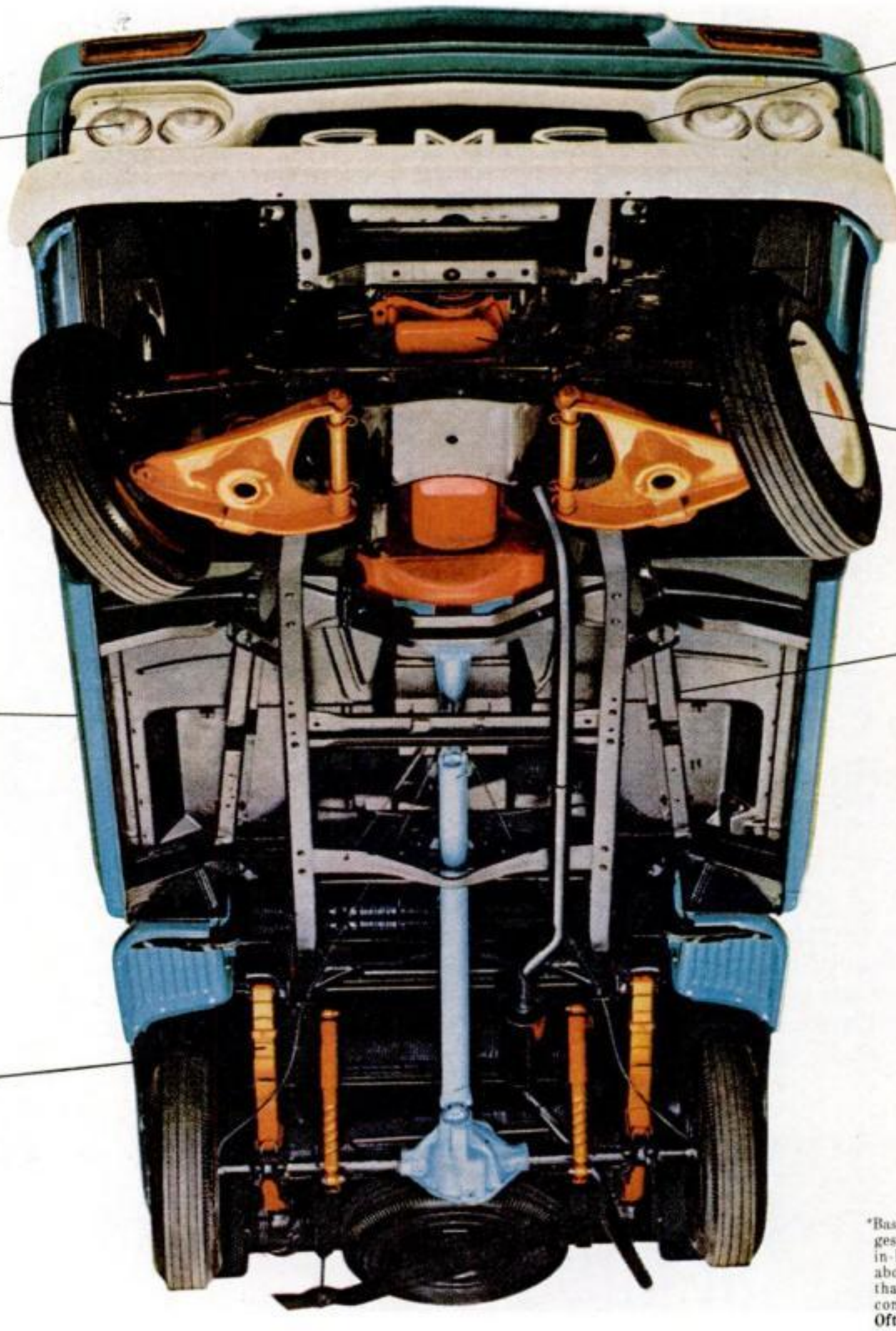
Underneath it all, this GMC pickup is misunderstood. People think it costs more than it really does.



Ordinary pickups have only two headlamps. The GMC pickup has four headlamps. See the light?

Think of this when you see these letters – made by truck people, sold by truck people, serviced by truck people. Remember that, before you buy a pickup.

Independent front springs take the sting out of road bumps – before they reach you and the cargo.

Most competitive engines don't have as much torque as this in-line six engine. Or as much cooling and lubricating capacity. Maybe that's why people think GMC costs a lot more.

Two walls of steel and a thick slice of insulation in the cab roof keep out sound and weather. (Some other truck-makers are content with a single wall and little, if any, insulation.)

Every inch of the metal is rust-proofed. *Every inch.* Even the metal you can't see.

The progressive-type rear springs automatically adjust to the weight of the load. The load is protected, the pickup body is protected, and so are you.

*Based on manufacturers' suggested retail prices, the GMC in-line six model pictured above is never priced more than $49 over comparable competitive base models. Often the difference is less.

Its price is only $49* more than others. Please tell your friends.

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TRUCKS
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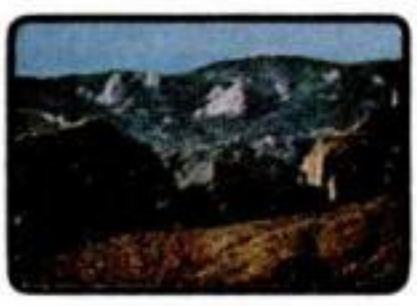

The Volkswagen Station Wagon comes with 21 views to choose from.

This is what the world looks like from the inside of a VW Station Wagon.

There are 21 windows all around. And a 14-square-foot hole in the roof.

So each of your nine passengers gets 2⅓ views apiece.

(The VW has twice as much room as most wagons, so we have room for a lot more windows.)

The best seat in the house is right behind the steering wheel.

There's no hood in front to look over because the VW engine sits in back.

(This design not only lets you see better; it lets you park easier. Our Wagon is only 9 inches longer than our Sedan.)

And the extra time you spend looking at scenery comes from the time you don't spend looking for gas. (23 mpg on regular is about average.)

Who knows? After you've looked out of one, you may want to look into one.

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flavorful...
distinctive!

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always sparkling, flavorful, distinctive!
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Popular Science Monthly
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Ford's Agile New BRONCO

By Jan P. Norbye Automotive Editor

WHEN the market for rugged, go-anywhere cars had grown to 50,000 units a year, Ford had an idea for a new type of lightweight four-wheel-drive sportsman's vehicle: a car that would go like a Mustang on the road and like a Jeep in the rough. Could they invent one? They tried, and came up with a sporty and tough workhorse called the Bronco.

Finding the weak spot in the Bronco concept proved an impossible task. I tried everything I knew—and failed.

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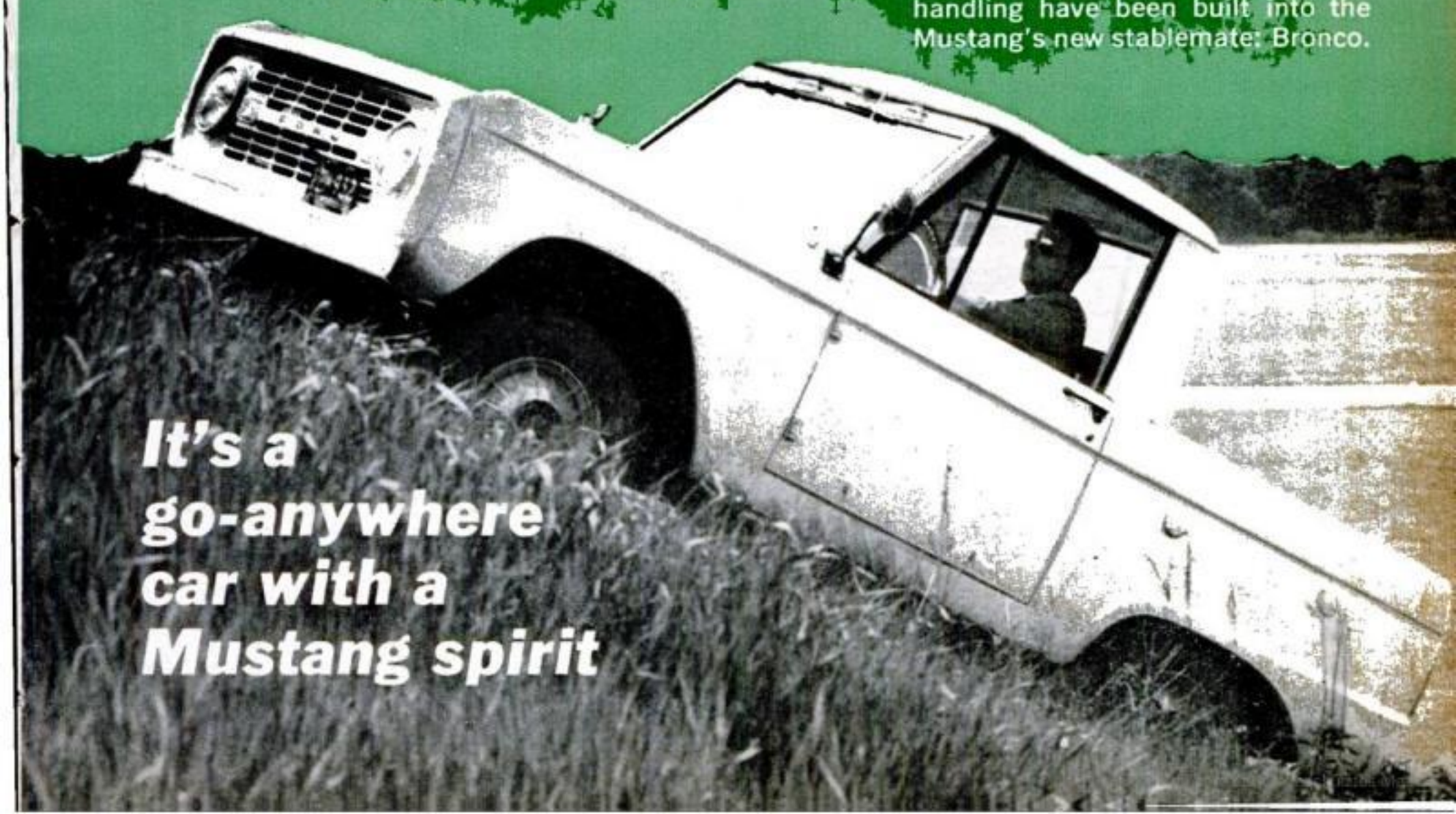
Passenger-car ride and sports-car handling have been built into the Mustang's new stablemate: Bronco.



It's a go-anywhere car with a Mustang spirit

It competes with the Scout and fills the gap between Jeep

Bronco steers as easily as some large passenger cars, despite four-wheel drive—and steering is free of wheel kick, vibrations, and rattles. Body lean on hard cornering is remarkably slight.

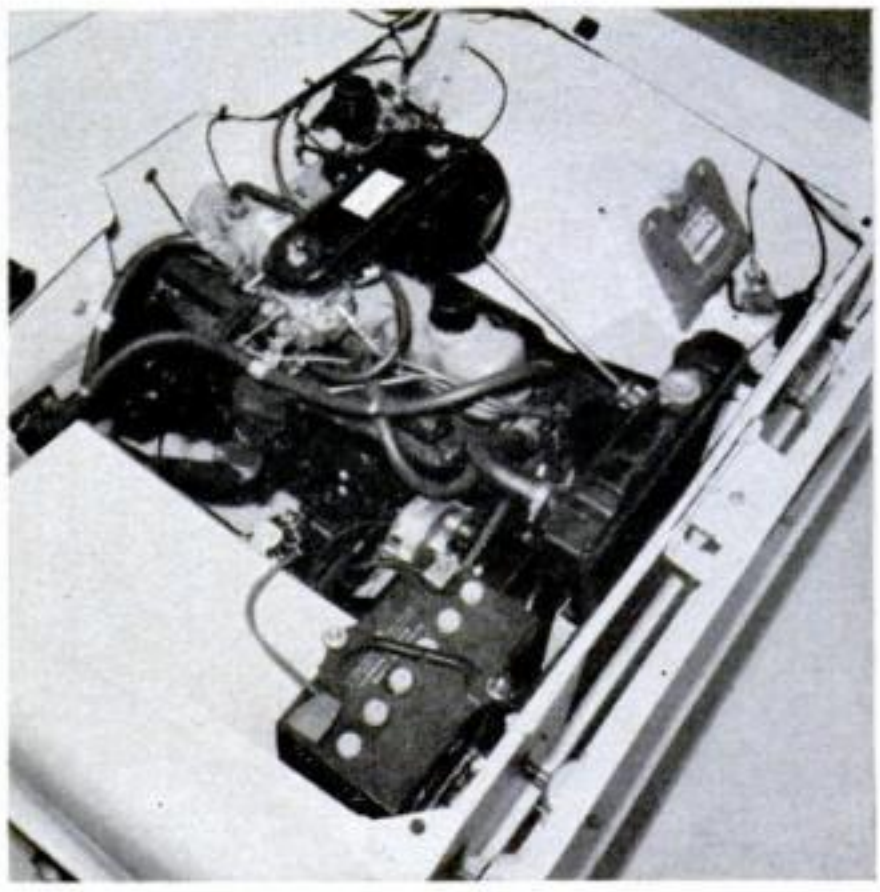
I stopped in foot-deep mud and let the Bronco sink in, only to drive out as if the mud were a pool of water. I ran it up a 45-degree grass slope, slippery with morning dew, and the Bronco climbed it in third gear, low range, with four-wheel drive. I put it through some hard cornering on a road course, and the Bronco behaved like a real sports car. I drove it at top speed—about 85 m.p.h.—down the straight, and the ride was better than in many taxicabs, the directional stability excellent, the noise level inside the vehicle quite tolerable.

Asking the "four-wheelers." The design goals for the Bronco were not laid down by Ford engineers—they were compiled from comments on existing go-anywhere cars by members of about 300 "four-wheeler" clubs all over the United States. Their total membership exceeds 10,000, and the consensus was that four-by-four sportsmen's and utility vehicles needed higher highway cruising speeds, ability to climb steeper grades, better weather sealing, more comfortable seats, improved ride comfort, and shorter turning diameters. That was what Ford set out to give them.

In addition to these requirements, James Heywood, Executive Engineer of Ford Trucks, demanded that Paul Axelrad, the Principal Vehicle Engineer for the Bronco, should make maximum use of existing Ford parts. This would not only assure ready availability of spare parts everywhere but also keep manufacturing costs down.

The engine. To power the Bronco, they chose the Econoline version of the 170-cu.-in. six, which differs from the Falcon's in having solid valve lifters instead of hydraulic ones. They also worked out a special carburetor with

Standard seat is a three-place bench, but Mustang-type bucket seats (above) are optional. Parking brake is foot-operated, controls are simple, and instruments are set in one large dial.



Six-cylinder 170-cu.-in Econoline engine puts out 105 hp. at 4,400 r.p.m., with 146 lb.-ft. of torque at 2,400 r.p.m. No power options exist now, but compartment is big enough for a V-8.

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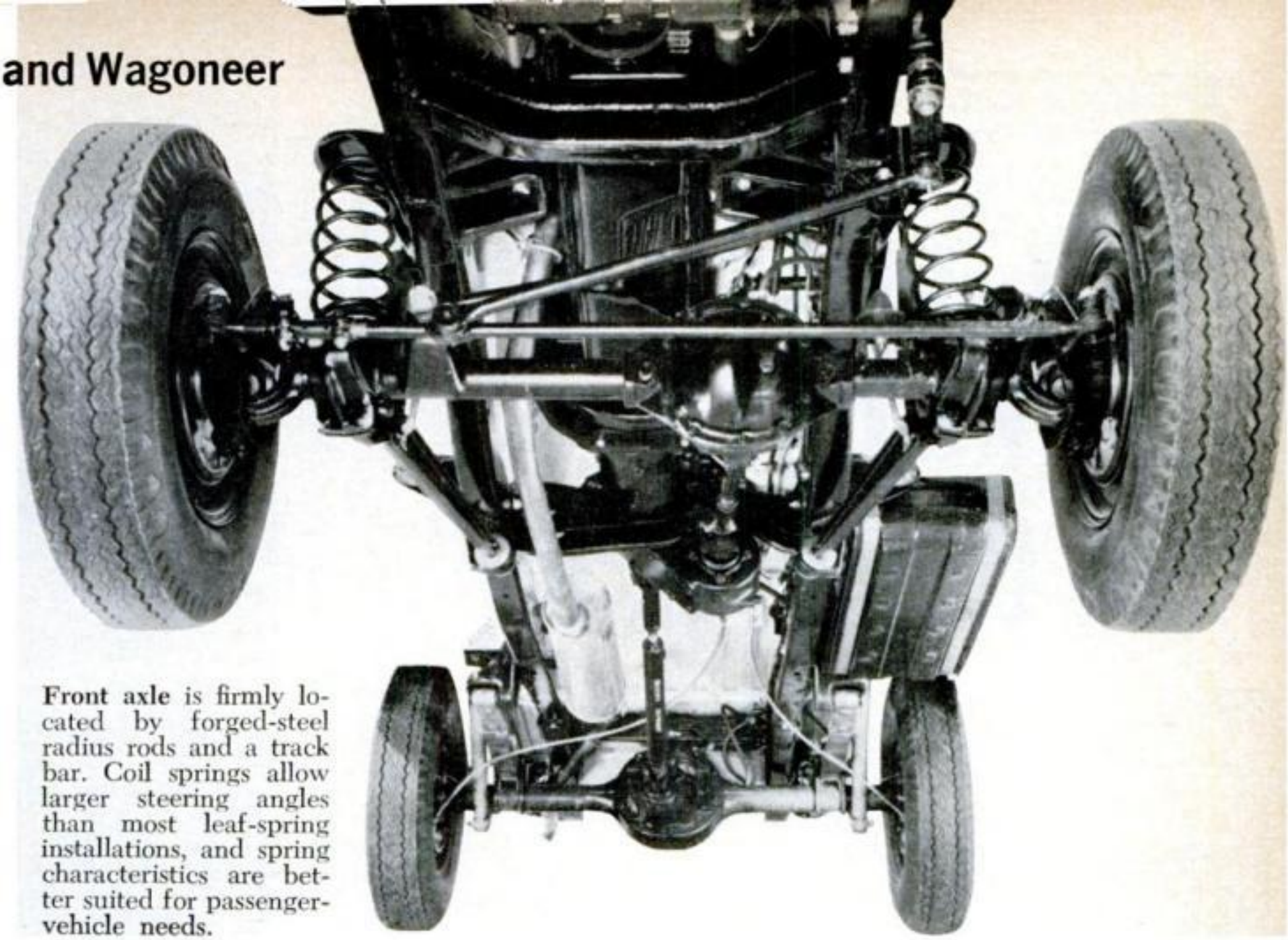
and Wagoneer



Front axle is firmly located by forged-steel radius rods and a track bar. Coil springs allow larger steering angles than most leaf-spring installations, and spring characteristics are better suited for passenger-vehicle needs.

floats designed to function up to a 60-degree climb or descent and a 20-degree lateral tilt. They replaced the usual dry paper filter with an oil-bath air cleaner and fitted an aircraft-type fuel pump that will deliver under all conditions. They redesigned the oil pan so it would clear the front axle and raised its capacity to six quarts.

I talked with Axelrad about the lack of power options for the Bronco, but he intimated that bigger sixes and V-8s might follow, with enough customer demand. Japanese "four-wheelers" such as Nissan and Toyota have 135-hp. base models, and Ford might do well to prepare a more powerful Bronco.

A ride in the Bronco. Now come with me for a drive. Before moving off, check the transfer-case lever by pulling it fully back and moving it one notch forward. That gives rear drive, high range (all the way back gives four-wheel drive and high range). Move the steering-column gearshift into first and start off. It's just like an ordinary car. Work your way up to third gear, speed up, find a road with some turns and some bumps. It rides better than a pickup truck, and the seats are more comfortable.

Now let's try it off the road. Get second gear. Steer for this open field. Move the transfer-case lever back—you don't have to touch the clutch, just pull. There you go, all four wheels driving. The ground is too soft? The car is slowing down even with full throttle in second gear? Just engage *first*. You heard me, first gear. At speed? Yes, go ahead. First gear has synchromesh, so there's no need to stop. Got it? Yes, the car is gaining speed again, the revs are rising and you begin to wonder about shifting up again. Don't do it; there's a better way. Slow down, declutch and rev the engine, move the transfer-case lever all the way forward (through neutral, into low range with four-wheel drive).

The Bronco rolled to a stop while you were working on that, but that's just as well. All set? Start off again in first

[*Continued on page 204*]

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How Jon Lindbergh Works on the Ocean Floor

He leads a team of divers who aim to prove they can work at greater depths, for longer periods, than has ever been done before. Stunt? No—pure business

By Gardner Soule

FROM a barge off the California coast near Santa Barbara, Jon Lindbergh (son of the famous aviator) and the other divers in his team will soon commute to work on the ocean floor 632 feet below. They will be proving that men can live and work for long periods exposed to the pressure of depths no diver has yet visited for more than a minute or two.

"We don't know how deep we can dive," Jon Lindbergh told me. "The 600 feet we'll try for this fall seems to us quite plausible. We may, in fact, try to keep a man at that depth for 24 hours."

Lindbergh and another diver, Robert Stenuit, have already established a record for length of time at great depths by spending 49 hours at 430 feet off the Bahamas, in July, 1964. They lived in an inflated rubber undersea "tent" developed by Edwin A. Link, inventor of the Link aviation trainer and now one of the foremost explorers of the ocean depths.

The dives off Santa Barbara will extend Link's techniques to demonstrate their commercial usefulness. Jon Lindbergh is a key man in Ocean Systems, Inc., a company organized at the beginning of this year as a joint subsidiary of two industrial giants, Union Carbide Corp. and General Precision, Inc. (Link's firm). Ocean Systems does underwater work for hire, and its objective is to be able to place divers anywhere on the world's continental shelves. Under 600 to 1,000 feet of water, these slopes surround the continents and make up 10 percent of the globe's area—an unknown region as large as Africa.

The technique to be used this fall is

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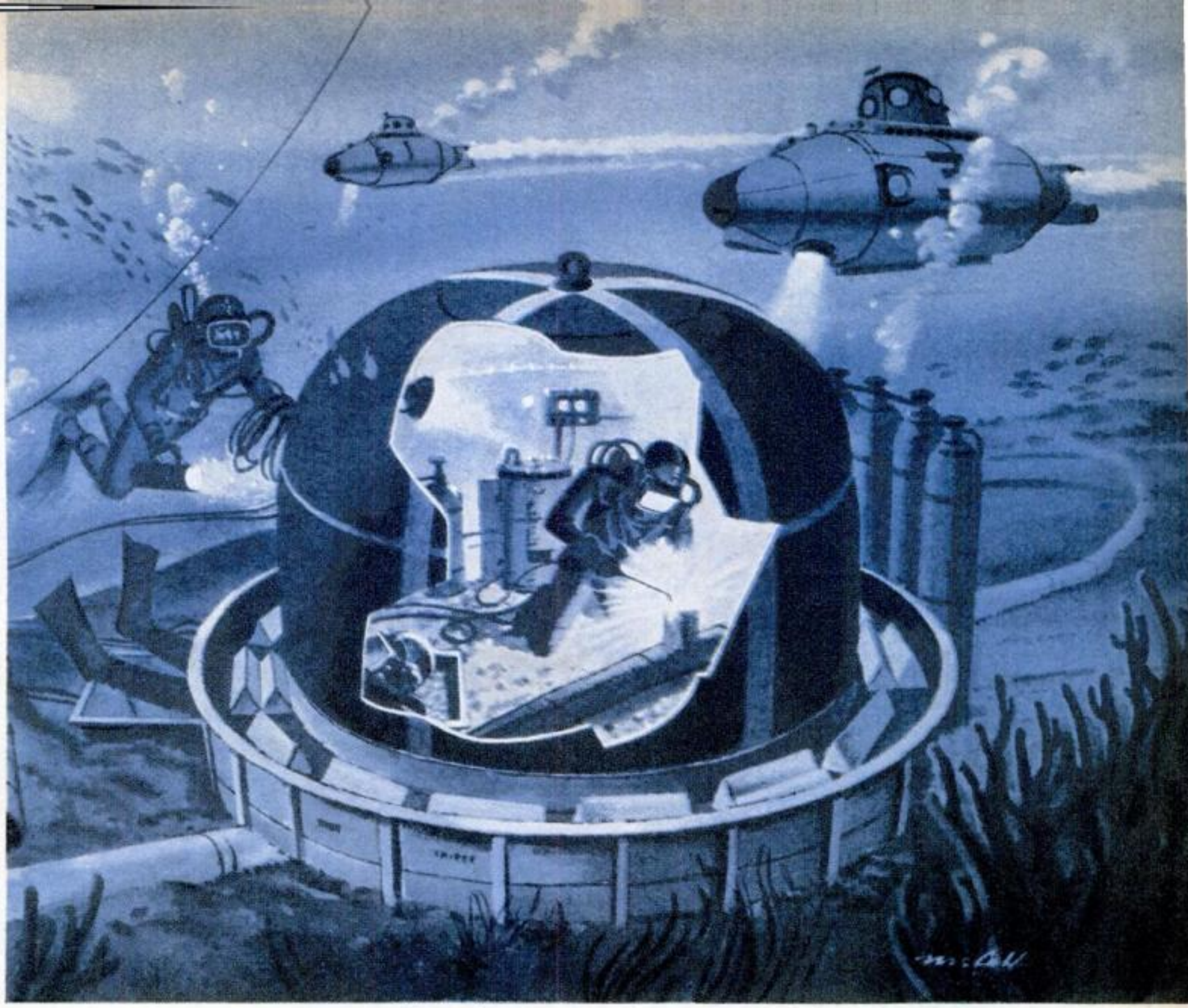

"Work camp" on the ocean floor shows techniques developed by Ocean Systems, Inc. Diving elevator, extreme left, rides up and down an anchored cable so it can always land at the same spot. Inflated "igloo" in foreground provides a dry area for work such as welding; diver enters through bathtub-like lock. One-man submarines, like the one in which Jon Lindbergh is seen on opposite page, are used to inspect and survey the diving site while the divers are at work.

what Ocean Systems calls the "commuter diving mode." Two-man teams of divers will travel back and forth between the barge and the wellhead of an abandoned oil well on the bottom, by means of a diving chamber that runs up and down an anchored cable to serve as an elevator. They will be kept under the same pressure as that on the sea floor, and they will breathe a special mixture of gases instead of air.

In a typical dive, Lindbergh and his teammate, Robert Stenuit, will begin by entering a pressure chamber on the deck of the barge. A mixture of helium, nitrogen, and oxygen will be pumped into the chamber to increase the pressure to that of the 632-foot depth. Doctors will observe them to make sure there is no adverse reaction to the pressure. The diving elevator's hatch will be mated to the hatch of the deck tank. Lindbergh and Stenuit will climb into the elevator. They will then be lowered to the bottom in a trip that will take only about 10 minutes.

In the diving elevator—actually two chambers, a sphere on top of a cylinder, with hatches in between—Lindbergh and Stenuit will put on insulated rubber suits that keep them warm in the water. On the ocean floor, they will open the bottom hatch of the elevator and swim out, trailing umbilical hoses that connect them to the breathing-gas apparatus of the cham-

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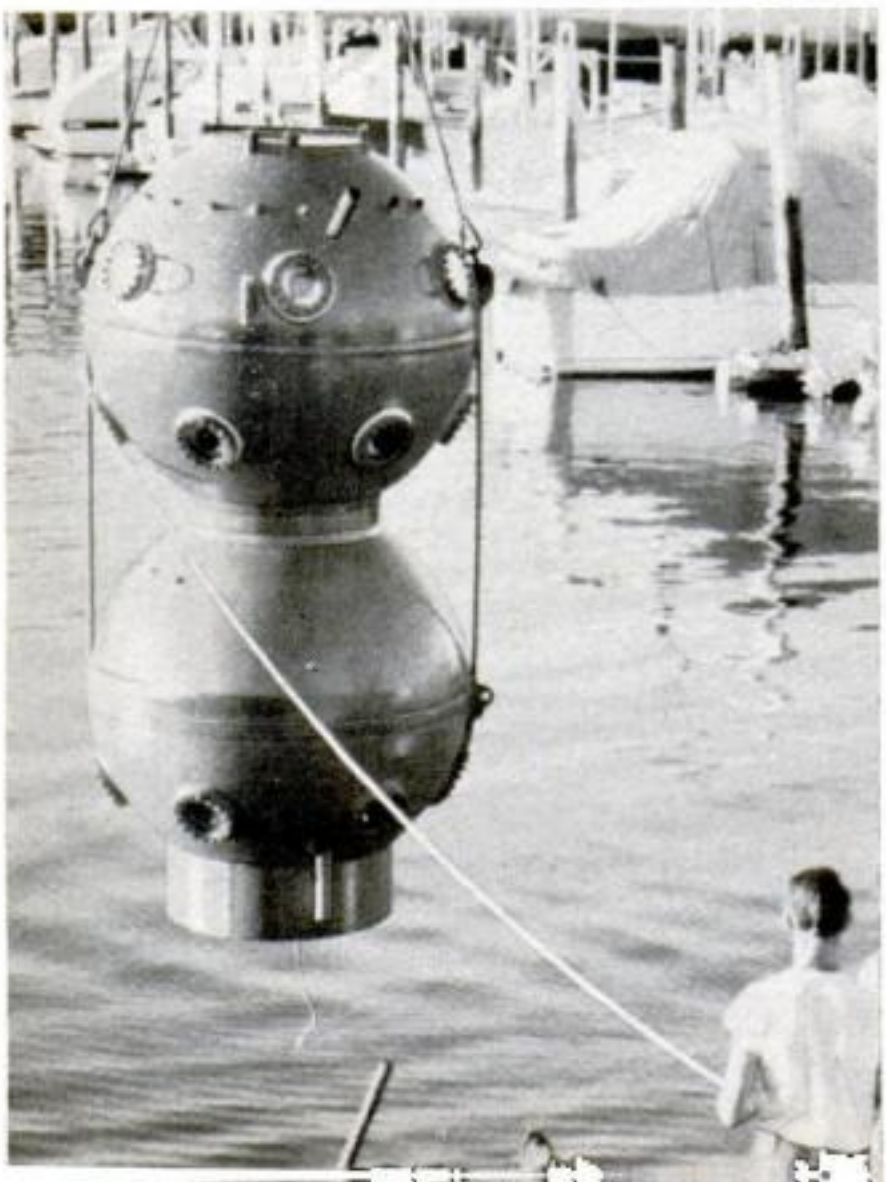
Urheberrechtlich geschütztes Material

ber. (It isn't practical to use aqualungs at such depths, since a few lungfuls would exhaust the supply of breathing gas they could carry; and the gas must be purified and recirculated, with its carbon dioxide removed and oxygen added.)

Deep-sea salvage. Under the glow of the blue-green lights that penetrate the inky depths best, although divers don't care for the eerie color of the light, they will work at salvaging pipe and other abandoned oil-well equipment. They will set up an igloo-shaped underwater workshop—simply a hemisphere of heavy rubber inflated with nitrogen and held down by weights—to provide a spot of "dry land" for some of their chores.

What will the divers see at 632 feet? There may be some surprises, but of earlier, somewhat shallower dives, Lindbergh says: "You often see long chains of small animals strung together—ribbonlike, sea-serpentlike things. You see ocean sunfish occasionally—the big, round, eight-foot-diameter Mola molas—and occasional sharks. You see octopuses if you look for them in the rocks; recently I saw a 19-footer, on a pipeline job."

One version of Ocean Systems' diving elevator is pair of spheres. Hatches between spheres permit observers to ride in top compartment while divers work out of the bottom sphere.



Lindbergh, who has been a diver since his Navy service 11 years ago, feels safe when he dives. "We don't have many close calls on the bottom," he says. "We stay away from incidents."

After two hours of work on the bottom, Lindbergh and Stenuit will return to the chamber and seal the bottom hatch. They will then be hauled back up to the barge, and the diving elevator will be mated to the pressure tank on deck. They will eat and sleep in the tank, where they will be under the observation of doctors who can enter through an air lock. For an estimated 36 hours, they will remain at the same pressure, commuting between the deck tank and the bottom. Then comes the long, slow decompression, which will take about 90 hours.

Diving in relays. Other teams of divers will alternate with Lindbergh and Stenuit during the series of dives. The deck tank's three chambers make for flexibility—one team of divers can undergo decompression while another team lives at deep-sea pressure. The two-chamber arrangement of the diving elevator also adds flexibility; the upper chamber can be maintained at atmospheric pressure and engineers can descend in it to watch through portholes and supervise divers working from the pressurized bottom chamber.

The elevator carries its own supply of breathing gases, which are mixed, recirculated, purified, and monitored by equipment in the chambers, but it is connected to the surface by an umbilical cable that provides continuous communication by television and telephone. Those on deck keep an eye on the divers by means of TV cameras mounted in the elevator, and the divers also have a portable TV camera that they carry out into the water.

Voice communication used to be a problem, since the helium the divers breathe makes them sound like Donald Duck and seriously impairs intelligibility, but Ocean Systems has developed an electronic unscrambler that restores the helium voice to near normal. The cable to the surface is an aid to the divers but is

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of the continental shelf

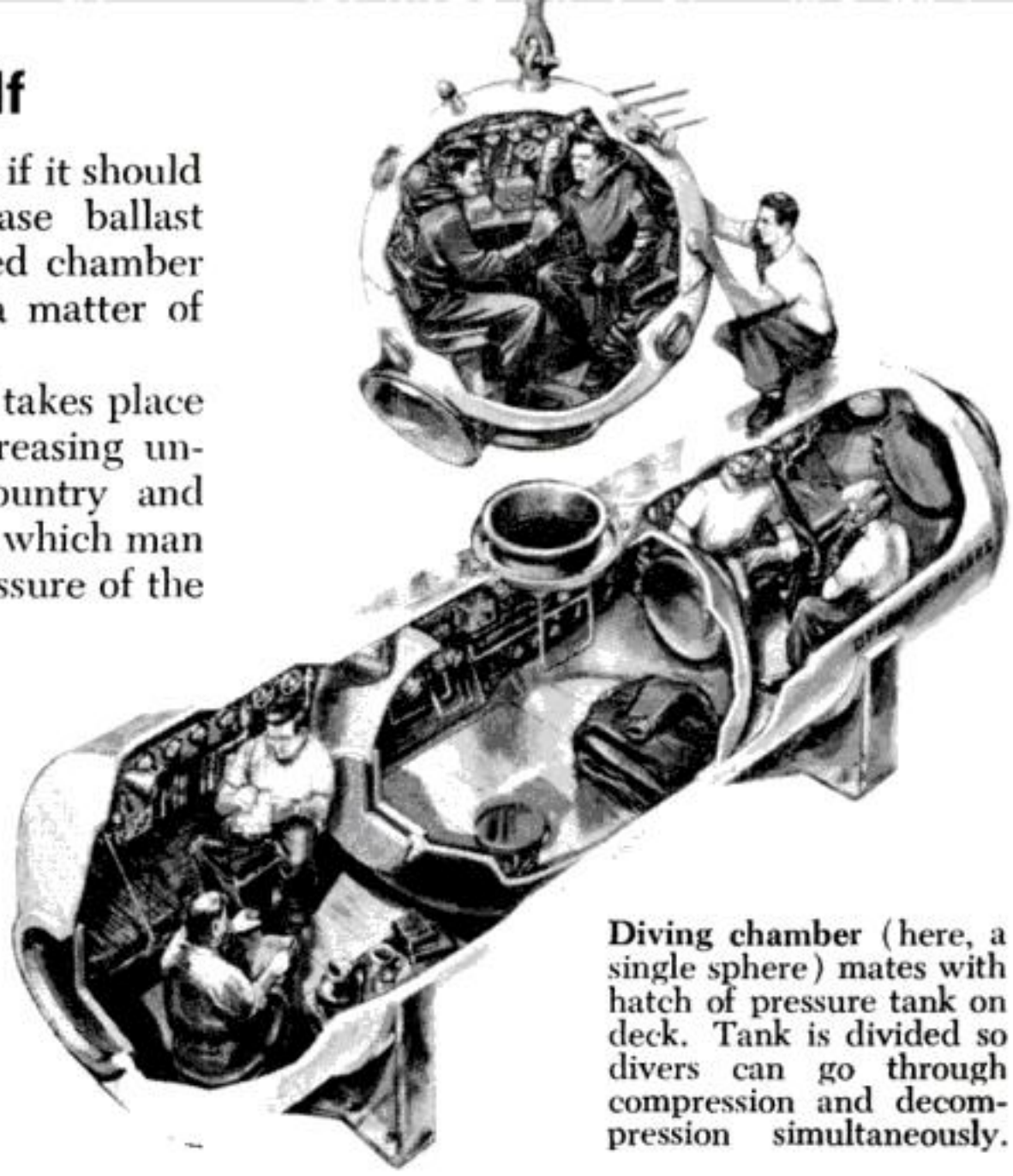
not essential to their survival; if it should break, the divers can release ballast weights from inside the sealed chamber and float to the surface in a matter of minutes.

The series of dives this fall takes place against a background of increasing underwater activity in this country and Europe. The deepest dive in which man has been subjected to the pressure of the sea was made by a Swiss diver, Hannes Keller, in 1962 off Catalina Island under U.S. Navy sponsorship. Using his "secret mixture" of breathing gases, Keller made a "bounce" dive to 1,000 feet (he stepped out of his diving chamber only momentarily).

With him was a British journalist, Peter Small, who was dead when the chamber reached the surface. Other dives—in addition to the Lindbergh-Stenuit feat of 1964—have shown that man can spend long periods under water. In the Red Sea, Capt. Jacques-Yves Cousteau of France maintained five divers for a month at a depth of 36 feet; two of their teammates stayed for a week at 90 feet. Last year, off Bermuda, in a U.S. Navy project called Sealab I, four divers lived and worked for 10 days at 192 feet. In Sealab II, off La Jolla, Calif., this year, divers were to spend 30 days at 250 feet.

In the work being done by Jon Lindbergh and the other divers of Ocean Systems, the emphasis is on accumulating experience and developing techniques that will be used increasingly for commercial exploitation of the resources of the ocean floor. They hope to make a big business out of drilling and maintaining oil wells, surveying routes for cables and laying them, laying pipelines and deep sewer lines, salvaging sunken ships, and mining the ocean floor.

"Hard-hat" tests. Their preparation for this work has been extensive: Lindbergh and the other divers have made 300 dives in which more than 40 minutes was spent at depths greater than 250 feet, using conventional "hard-hat" diving equipment. They are carrying out a series of "dives" on dry land, in pressure tanks, simulating depths as great as 1,000 feet. Ed Link has also supported research in which mice have survived simulated dives at pressure equivalent to that 5,000 feet under the ocean.



Diving chamber (here, a single sphere) mates with hatch of pressure tank on deck. Tank is divided so divers can go through compression and decompression simultaneously.

Although these experiments are encouraging, difficulties remain to be overcome before divers can go to such depths with complete confidence and safety. Breathing of gas mixtures, timing of decompression, protection against the cold of the depths—these and other problems must be carefully studied in the conquest of an environment new to man.

When Jon Lindbergh and Robert Stenuit step out of their diving chamber at 632 feet this fall, they will be exploring territory that is, in its own way, as foreign to man as the surface of the moon. They plan to go much deeper, however—and it may turn out that there is no limit to the depth at which man can live in the sea. ■ ■

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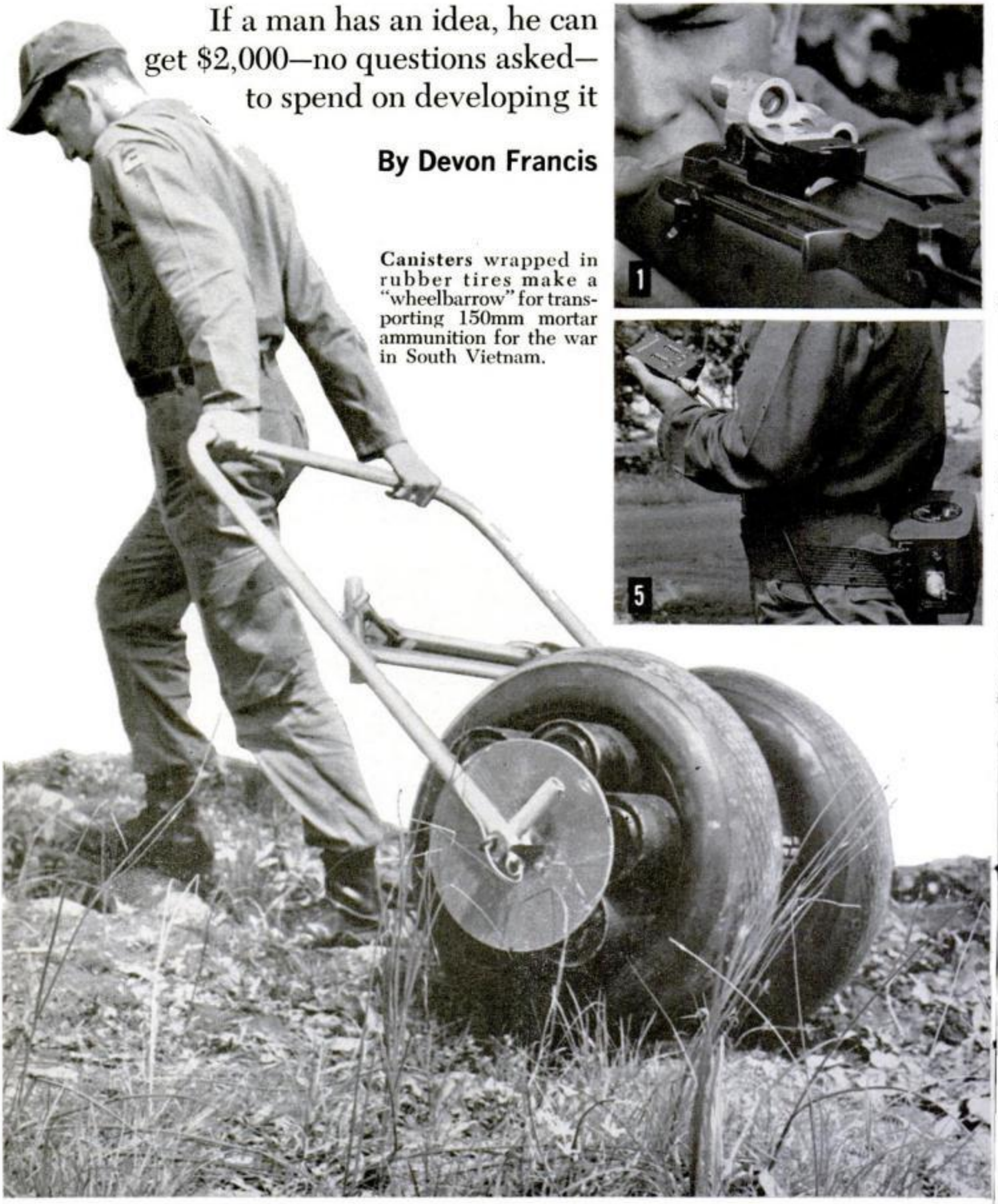
INVENTORS' UTOPIA

If a man has an idea, he can get $2,000—no questions asked—to spend on developing it

By Devon Francis



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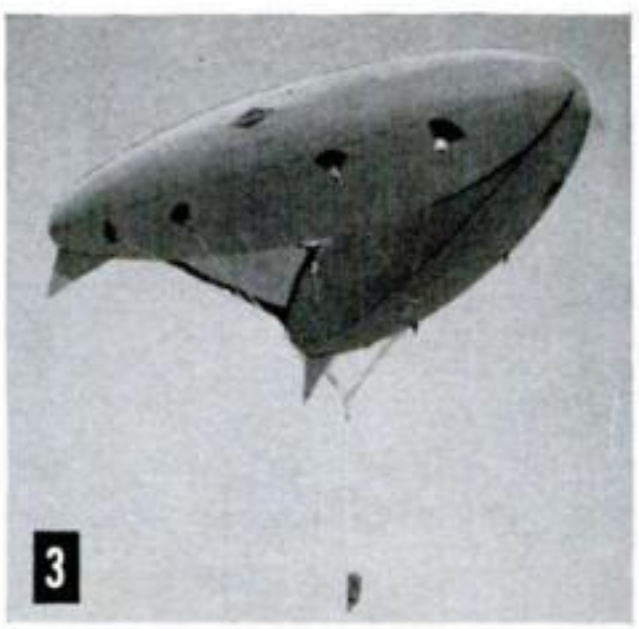
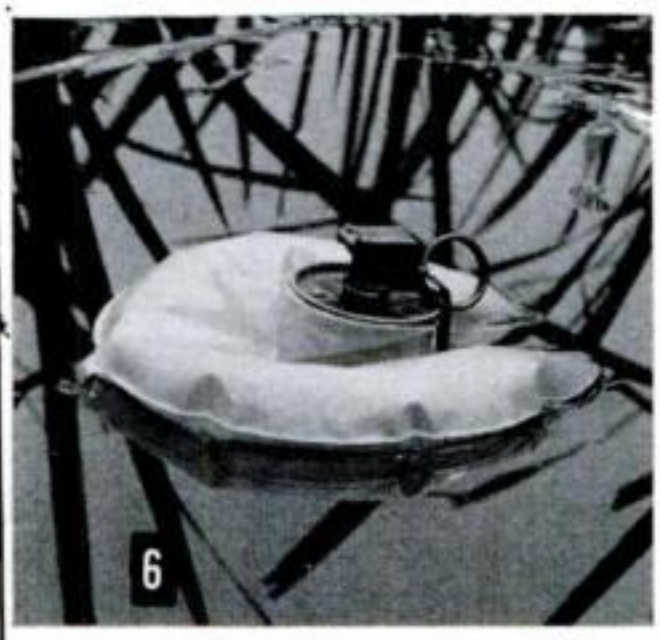
Canisters wrapped in rubber tires make a "wheelbarrow" for transporting 150mm mortar ammunition for the war in South Vietnam.

Urheberrechtlich geschütztes Materia

A lab where they dream up weapons for nasty little wars





For Vietnam, Limited War Laboratory designed these items, among many (see numbers on pictures: **1**) a supersecret gunsight that "makes every soldier a sharpshooter"; **2**) bullet detector (arrow) for helicopters that picks up ballistic shock and muzzle-blast waves; **3**) weather-cocking balloon for radio antenna; **4**) insert to make a shotgun out of a handheld grenade launcher; **5**) portable computer that gives position readings to scouting parties; **6**) plastic, air-filled collar to float smoke signals in rivers and lakes; **7**) mirror signaling device (part of a survival kit) that can be aimed like a rifle; **8**) adapter plate (shown in photograph in the process of being machined) for either a helicopter-borne rocket or for a grenade launcher.

ON CHESAPEAKE Bay, where each day earth and sky and blue water tremble to the *whump* of the U. S. Army's big guns on a proving ground of 75,000 acres, some pretty weird things are going on now. Take a look:

- There is a busy little group of men who were presided over—until recently—by an Army officer who, to say the least, was rather light-fingered with other people's property.
- These men spend the taxpayers' money on any ideas that strike their fancy.
- In a nuclear age, they are reinventing some weapons that are suitable only for refighting the Indian wars.

Now, all this isn't as screwball as it sounds, and if you will stick with me for a few minutes we will get all the facts sorted out and explained. First of all, let's be fair—these chaps I have described are members, intellectually speaking, of one of the world's swankiest scientific clubs. They live in an inventors' Utopia.

If any one of them has an idea, all he has to do is ask for $2,000 to develop it. He gets the money, no questions asked. If the idea begins to show promise, more

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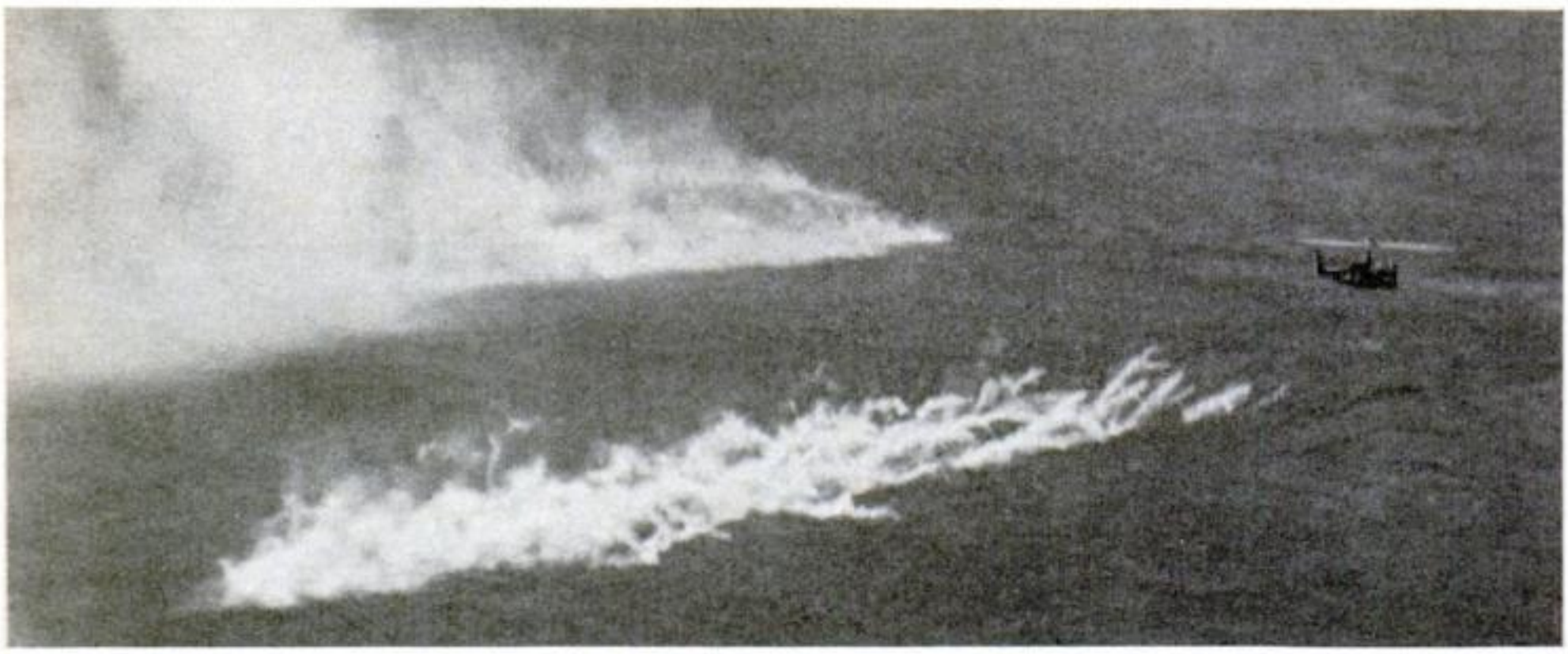
LWL reacts quickly to battlefield emergencies with hardware



Typical problem: Vietcong, hidden at forest edge, were picking off troops as they emerged from helicopters. Solution was to design smoke-screen system to hide friendly soldiers until they had a chance to dig in. Chemists, mechanical engineers, and analysts determined how to make the smoke, how to disperse it, and what the height and speed of aircraft using it should be.

money is put into it. If it doesn't, nobody jaws at the man who proposed it.

The club, known as the Limited War Laboratory, is unique. Its roster contains only 86 names. It reports directly to the Chief of Research and Development. It is headquartered at the world-famous Aberdeen Proving Ground in Maryland. Some of the weapons it develops are primitive simply because they help accomplish its purpose—to find ways to fight nasty little brushfire wars effectively.

The idea behind the Limited War Laboratory (LWL) is that if today's world is too scared to engage in the holocaust of nuclear war, then the grubby, foot-slogging kind of war (as witness Korea) may be with us for years to come. Now it has become tinctured with guerrilla warfare (as witness Vietnam). The weapons for this kind of warfare must be tailored precisely. You don't go duck hunting with an elephant gun.

Success story. The LWL has been a thumping success. In the stuffy verbiage of the military, it has become expert in developing a "quick reaction capability for meeting Army operational requirements." In plain language, that means the LWL has sent more than two dozen items to Vietnam to help fight a dirty, shoot-from-behind-a-tree war against the Vietcong.

They include such things as a "bullet detector" to tell the deafened crew of a bellowing helicopter that it is being fired on; a position finder, so soldiers won't get lost in the jungle; an artillery-ammunition carrier where the shell canisters themselves are part of the carriage; a treetop airport; and a mirror-signaling system that, in simpler form, the U. S. cavalry used in fighting the Apaches.

All this, and a lot more, has transpired within three years. Some of the devices came into being in months, and that's the point—it customarily takes five years to route Army materiel, whether it's a button or a bazooka, through Research and Development. The LWL can react promptly because the 79 civilians and seven officers who compose it are free spirits. They are color-blind to red tape.

The LWL scientist has but to think, doodle, and discuss. Some of the finest metal- and wood-workers on the eastern seaboard, equipped with power tools that would make any inventor faint with envy, are at his command to convert idea into reality.

The LWL got started back in 1962 because the South Vietnamese were getting

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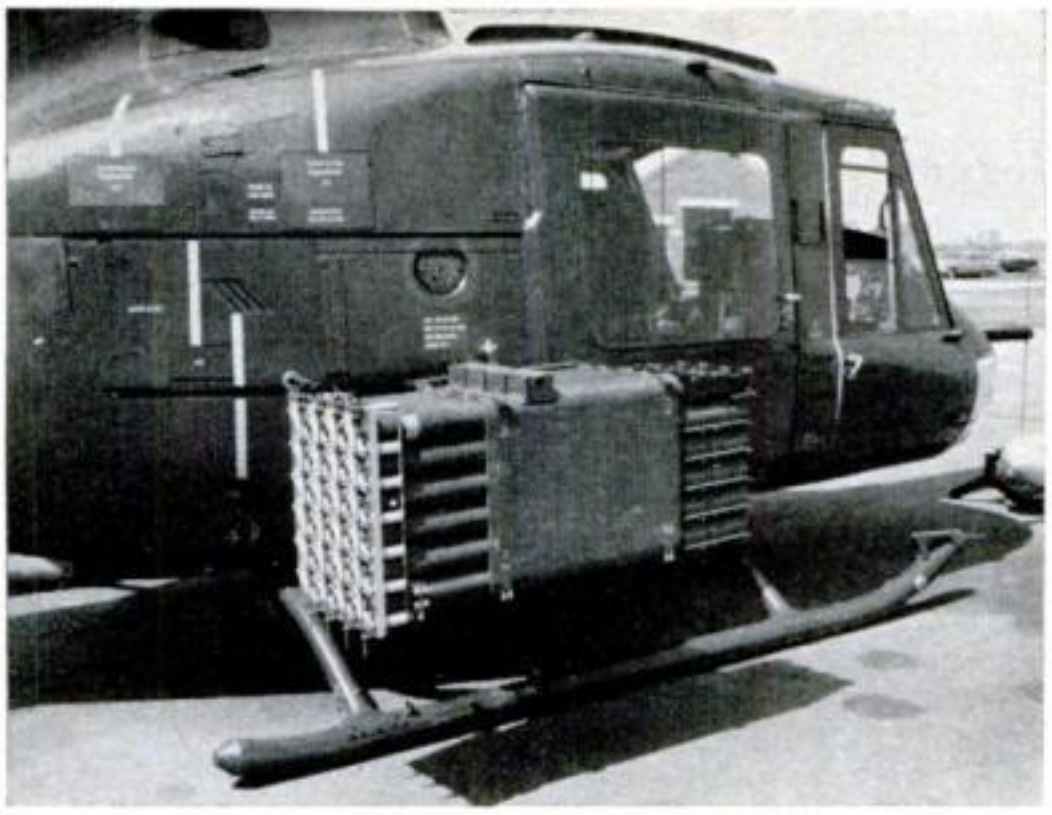
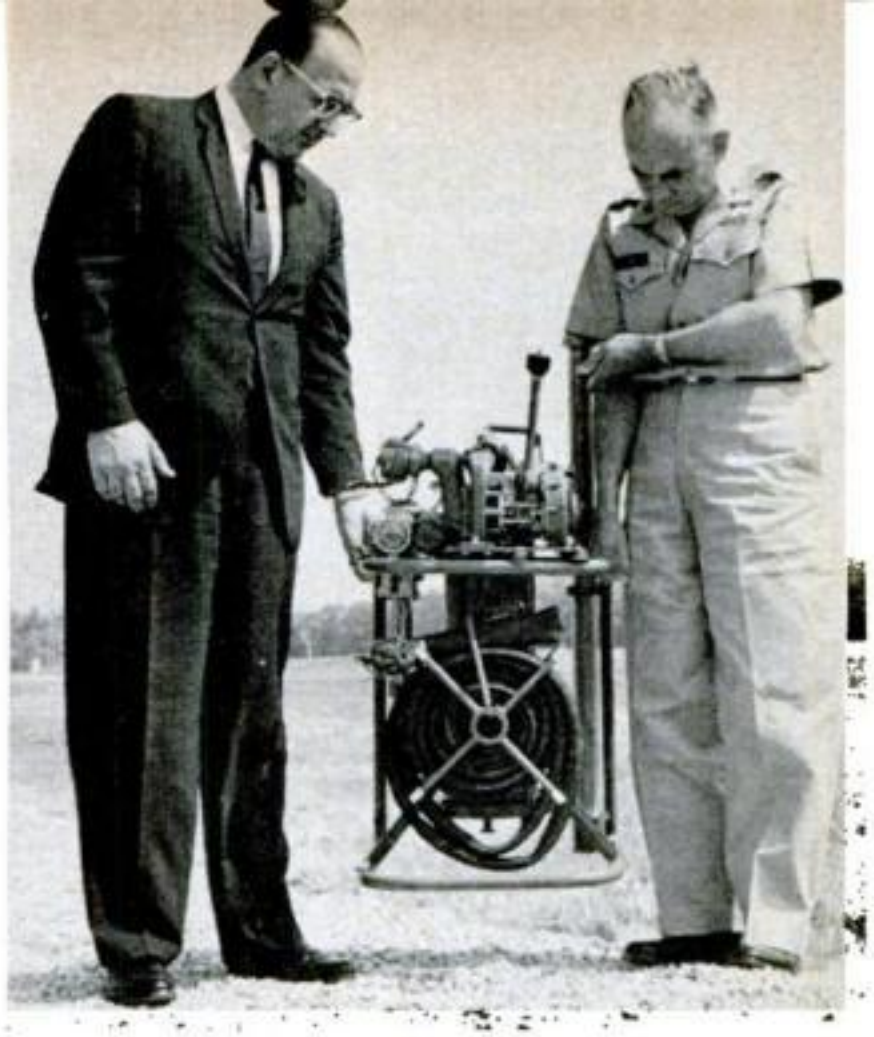
for special conditions



Laying a smoke screen is made automatic with continuous sequencing switch, solenoids, and spring-operated launchers. This smoke generator is now supplanted by round container.



Kaprelian (left) and Colonel Holmes hold pump operated by gas engine of only 85/100 hp. It delivers 25 gallons a minute for chopper refueling as against 2½ by hand-pumping.

clobbered with homemade firearms. This was a kind of warfare that confounded today's sophisticated weaponry. From the ranks of Army Materiel a colonel named Sterling Clinton Holmes was plucked to do something about it.

"Collect some brains," Holmes was told. A combat officer in World War II, Holmes was a deceptively mild man, with a grip like a bulldog's.

The first brain. Holmes began by acquiring a brilliant mechanical engineer, Edward K. Kaprelian, then 49, as his civilian deputy. Kaprelian at that time was deputy director of research at the Army's Signal Corps lab at Fort Monmouth, N. J., and was loath to leave. The LWL staff is about as gossipy as tranquilized clams, so it's hard to get at the facts. It probably is not true (as is rumored) that Holmes stunned Kaprelian with a blow on the head and spirited him away in an unmarked car.

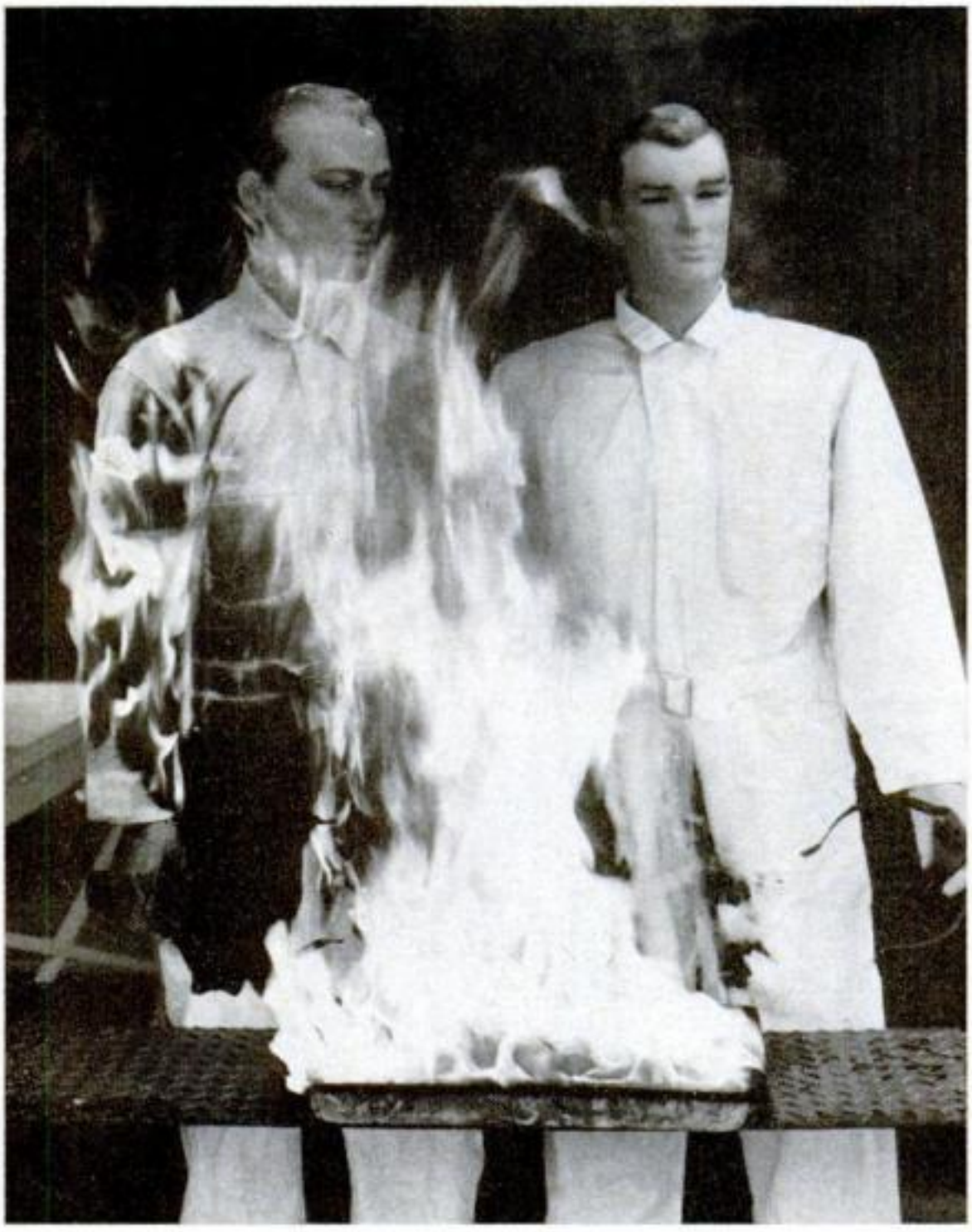
Anyway, recalls Kaprelian, "All of a sudden, here I was."

The LWL now consisted of two men who discovered, to their mutual delight, that they both were wholly without scruples in tackling Phase One of the project. That was to staff their lab with several

[*Continued on page 192*]

Strictly peculiar to jungle warfare is this snubber (right), which enables a paratrooper to govern his rate of descent on a safety line after a treetop landing. Shown in use below, the device became necessary for jumpers hitting forest clearings—if they barely missed, trees collapsed their chutes, plunged them to ground.

Urheberrechtlich geschütztes Material



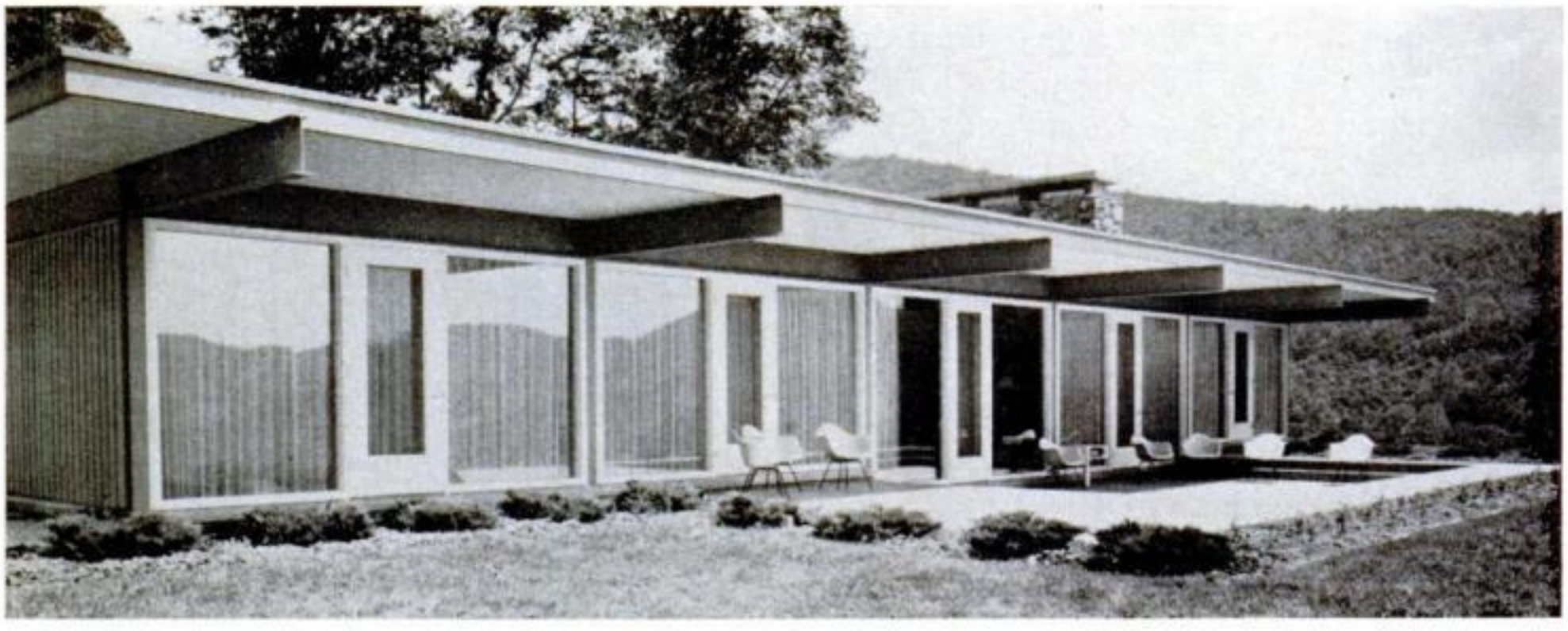
Sparks from welding torch won't burn fireproof shirt and pants.

Fireproof coveralls

Flames on a bench in front of these mannequins (photo at left) won't spread to noncombustible clothing worn by the one at right, while it engulfs the figure at its side in untreated clothes.

The fire-retardant Roxel fabric, developed by Hooker Chemical Corp., remains resistant to burning for the life of the material, isn't affected by laundering. It's made by a number of mills.

Coveralls at far left burn; at right they are barely charred.



Hillside residence is built entirely of steel

This all-steel home at Asheville, N.C., won two citations given this year by the American Iron and Steel Institute: excellence both in design and engineering. The 48-by-70-foot one-story residence has a fine southern exposure on a hillside just north of the city. It was built for Hyman Dave, president of a local steel-fabricating plant, and uses many of the Dave products. It consists of 10 bays for living

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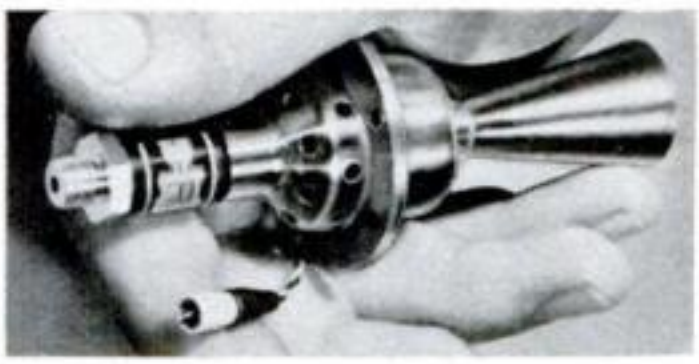
Sea-going catamaran

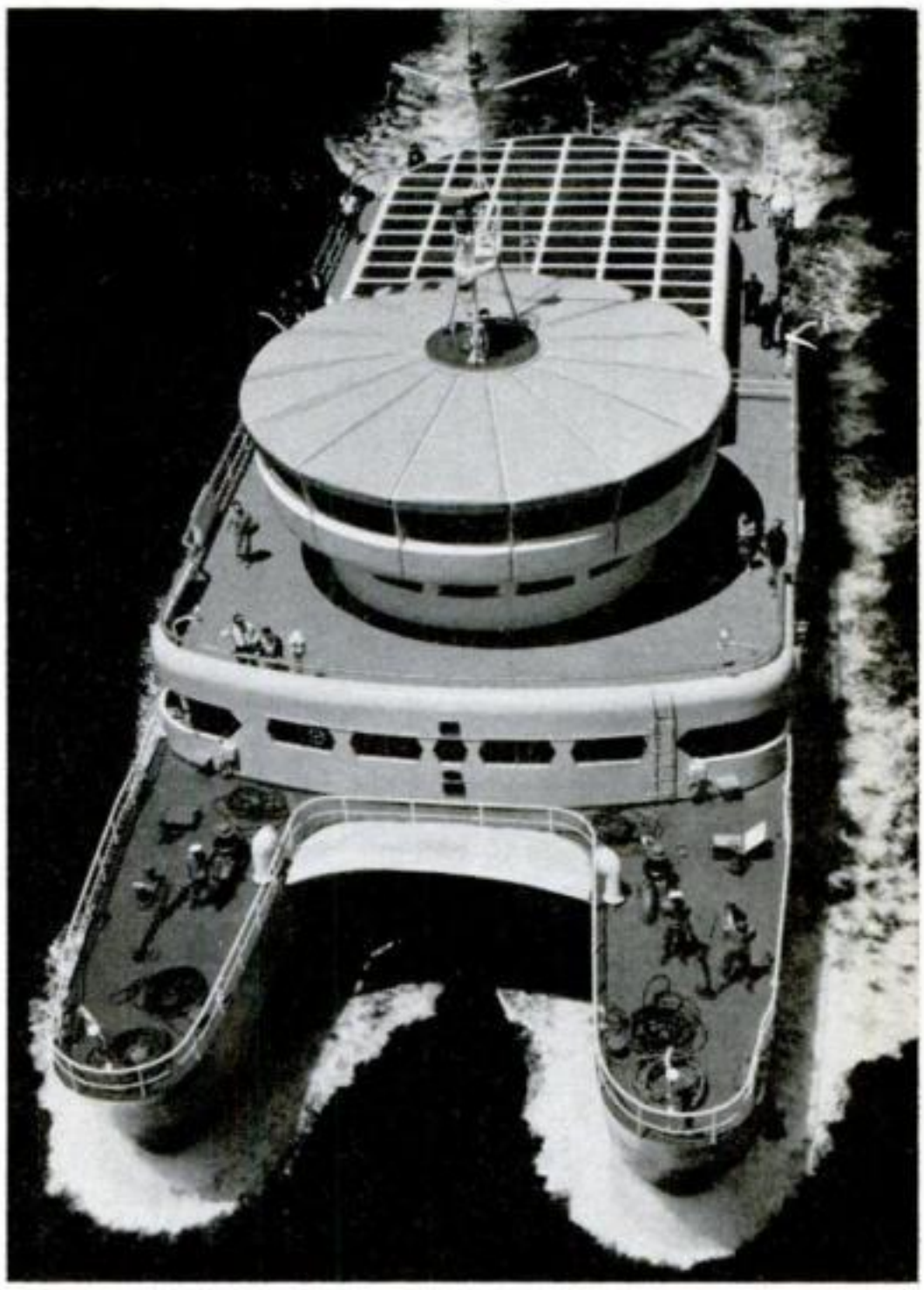
The luxury excursion catamaran at right is shown cruising on Japan's Seto Inland Sea. Built by Nippon Kokan, the Sea Palace displaces 430 tons. It's air-conditioned, can carry 297 passengers and 15 automobiles.

The circular dome above its upper deck covers an observation lounge and refreshment counter.



Tiny thruster does big job

A hydrazine-propellant rocket small enough to hold in the hand has been developed to change the orbits of satellites and other space vehicles. Using a new catalyst that causes hydrazine, a clear liquid, to decompose spontaneously into nitrogen, hydrogen, and ammonia gas, it produces reliable pulsing control thrusts.



Entrance to all-steel home is flanked by mesh panels. Patio (left) has steel beams at roof.

Permanent dining-room table is 10 feet long, rests on single leg of tubing set in concrete.

space and two special bays for the entryway and a carport. An open patio connecting with the living room is partially covered by an eight-foot cantilevered roof. Two exterior walls are floor-to-ceiling glass set in steel frames; the other two are ribbed-steel siding. Cost to build was $18.40 per square foot including extras. Fire insurance is cut 20 percent, and maintenance is low compared with traditional homes.

Urheberrechtlich geschütztes Material

REPORT FROM THE DRIVER'S SEAT

Precision engineering and Pullman-coach comfort, plus responsive handling, make:

Two Gems for Car Lovers

ROVER 2000 and BMW 1800 TI are two cars

By Jan P. Norbye Exclusive Photos by Bill Morris

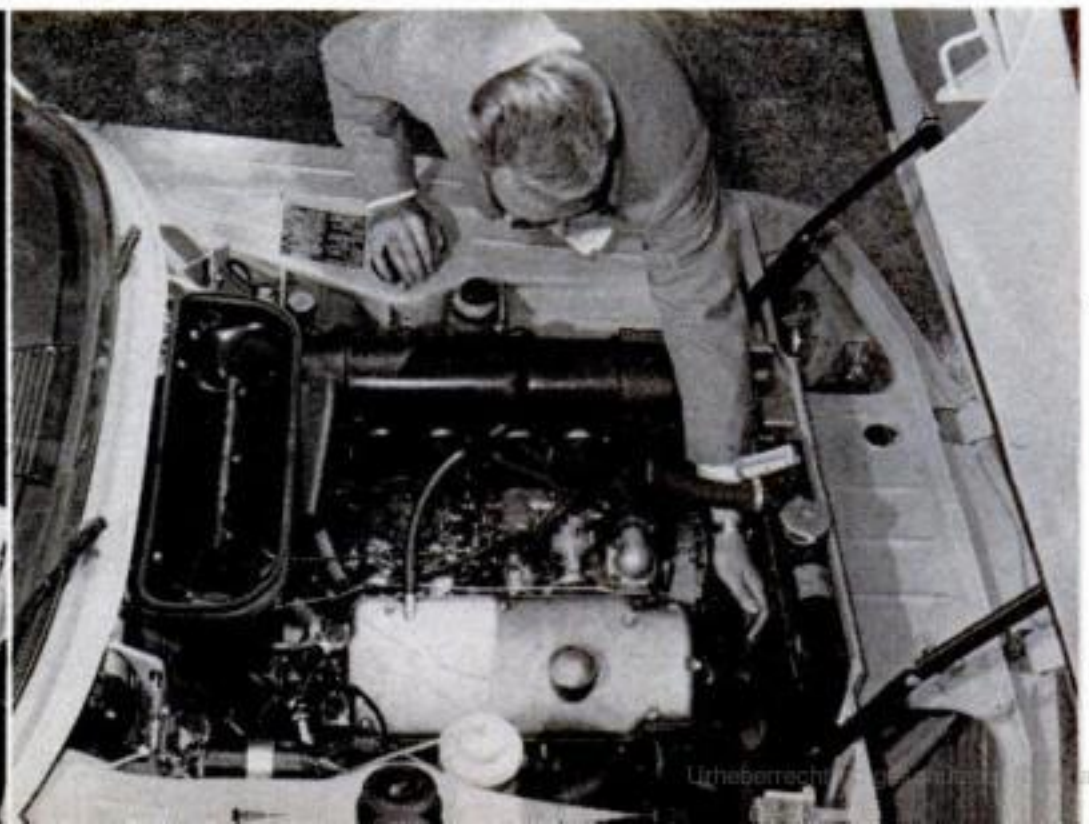
YOU'LL never be completely satisfied with ordinary cars after trying out the BMW 1800 TI or the Rover 2000. They bring out the best of your driving ability and seem to sense what you're going to do before you do it. After an all-day drive, you'll find yourself more exhilarated than tired.

To automobile enthusiasts, these cars are true gems. They are roomy and comfortable, yet compact in outside dimensions. They have economical four-cylinder engines, yet their performance is sparkling. They were built as family sedans, yet their handling puts many sports cars to shame.

It's remarkable that cars having so much in common should come from totally different backgrounds. The BMW (for Bavarian Motor Works) 1800 (for engine displacement in cubic centimeters) TI (for *Turismo Internazionale)* is

ROVER steering column ends just ahead of the cowl (indicated by the author's right hand) for extra crash safety. Hood is alligator type.

BMW hood tilts forward and gives remarkable access to engine. Author's left hand points to plastic fan—inexpensive, light, and reliable.



for the connoisseur. The English Rover is more luxurious, the German BMW more powerful.

the Munich factory's top-of-the-line model, born and bred within sight of the Alps, where performance counts.

The Rover 2000 (displacement again) is a product of the British Midlands, built by the same quality-conscious people who make the Land-Rover. For the 2000, safety and comfort were the design keynotes.

The gems on the road. The greatest assets of the BMW and the Rover lie in the chassis refinements rather than in the power train. On a narrow country road you can place these cars within a fraction of an inch of the white line or the ditch, on every turn, going through mile after mile of winding road almost without speed variations. The steering is lighter on the Rover; the BMW has superior directional stability. The suspension engineers have done a brilliant job on both.

Both of the cars use coil springs all around, but the wheel-locating systems are completely different. Both have shunned the normal rear axle, feeling

CONTINUED

ROVER steering wheel is adjustable for height. Compact instrument cluster is remarkably complete; clock overlooks a full-width shelf.

BMW has round instruments, and dials include a tachometer. Ignition key also locks steering column. Transmission tunnel has handy tray.

ROVER seats recline without notches and allow easy posture changes during travel. Ample seat padding in right places gives tireless ride.

BMW seats are 2½ inches higher than Rover's, also recline without notches, and have 5½ inches fore-and-aft adjustment against Rover's 8.

that good adhesion on bad roads can only be obtained by all-independent suspension. They have done away with axle tramp, wheel hop, spring wind-up and other torque-reaction phenomena that beset all rear axles to some extent.

The BMW rear suspension belongs to the same family as the Corvette's (and the latest Corvair's) but has lesser camber variations in deflection. The rear wheels on the Rover are connected by a variable-length de Dion tube, which maintains them in a constantly vertical position on the road.

At the front, the BMW carries the springs on a strut fixed to the control arm at the bottom and to the body structure on top. The Rover's springs are placed horizontally, working against the cowl structure, and acting through a linkage coupled to the control arms.

On hard cornering, the Rover leans a little more than the BMW. But the Rover has a lower pitch frequency, which gives a better ride as soon as the road has some unevenness. On a bad road, the BMW ride can get somewhat choppy. Both cars have marvelous bite on the road. They are well balanced and remain obedient to the steering wheel way beyond normal speeds. Such response probably contributes more to traffic safety than any "safety device" I can think of.

How to make a gem. The most recent BMW and Rover designs came about because both factories needed a new base model for a range of medium-size cars. Both wanted to do some unconventional engineering; both felt they could absorb heavy design and development expenses if they could produce a final design that would stay modern for a long time. As a result, the cars are full of technical innovations. The usual "teething troubles" were solved on the drawing boards and test tracks before the cars were put in production.

BMW had much experience with cars powered by rear-mounted motorcycle engines, and Rover had built an experimental turbine car with front-wheel drive; still, both factories chose front engines and rear drive.

Neither had any experience with overhead camshafts, but they chose a single-OHC four. However, BMW chose a hemihead while Rover placed all valves in line and located the entire combustion chamber in the piston crown, diesel fashion.

Rover and BMW apparently agree that five-bearing crankshafts and new en-

[*Continued on page 200*]

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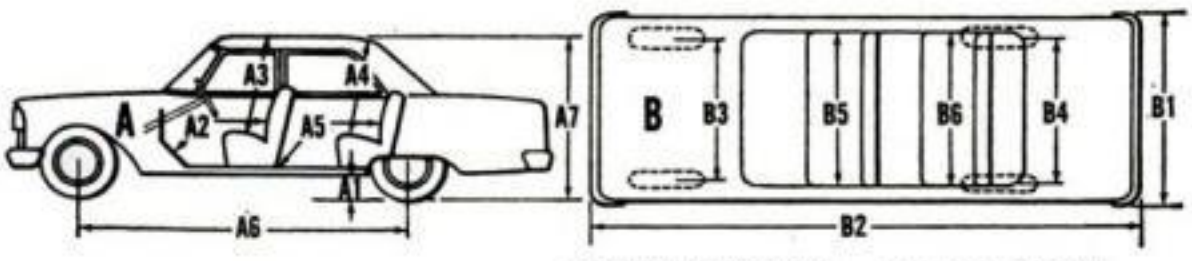
ROVER trunk space is restricted by spare-wheel mounting. Back-up light is vulnerable (under bumper bar). Loading height is nice and low.

BMW trunk is vast (21.2 cubic feet). Tank and spare wheel are located under trunk floor. Both cars have rubber cushions on the bumpers.



BMW 1800 TI Rover 2000

DIMENSIONS (inches)

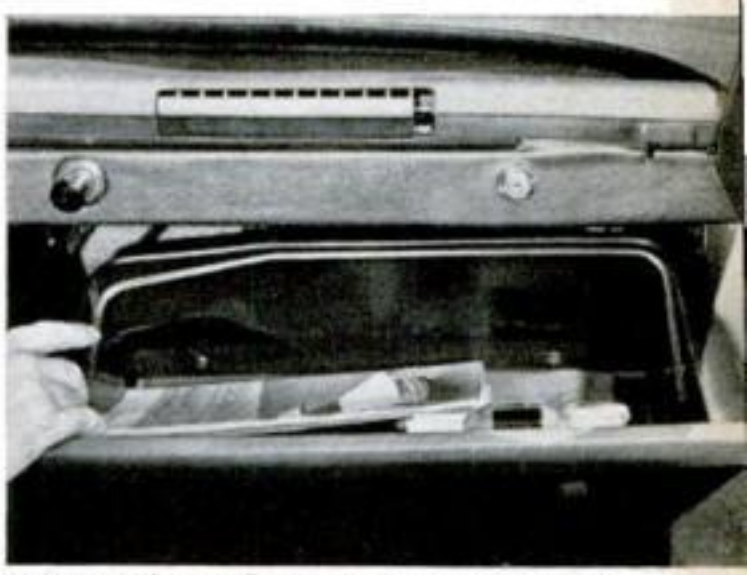
		BMW 1800 TI	Rover 2000
A1	Ground clearance	5.5	8.5
A2	Front legroom	46.0	49.5
A3	Front headroom	35.0	35.25
A4	Rear headroom	35.0	33.0
A5	Rear legroom	42.25	39.5
A6	Wheelbase	100.5	103.375
A7	Overall height	56.0	54.75
B1	Overall width	67.3	66.5
B2	Overall length	177.0	178.5
B3	Front track	52.2	53.375
B4	Rear track	53.8	52.5
B5	Front-seat width	23 (2)	20.5 (2)
B6	Rear-seat width	52.0	54.0

SPECIFICATIONS

	BMW 1800 TI	Rover 2000
Engine type	OHC slant-four	OHC vertical-four
Bore & stroke	3.31 x 3.15 in.	3.375 x 3.375 in.
Displacement	108 cu. in.	120.8 cu. in.
Compression ratio	9.5:1	9:1
Carburetion	2 2-bbl.	1 1-bbl.
Fuel grade	Premium	Premium
Tank capacity	14 gal.	14.4 gal.
Power	124 hp. @ 6,000 r.p.m.	90 hp. @ 5,000 r.p.m.
Torque (lb./ft.)	118 @ 4,000 r.p.m.	113.5 @ 2,750 r.p.m.
Transmission	4-speed all-synchro floor shift	4-speed all-synchro floor shift
Axle ratio	4.11:1	3.54:1
Tire size	6.00x14	6.50x14
Steering system	Worm and roller	Worm and roller
Steering ratio	17.6:1	20.3:1
Turns, lock to lock	3½	3¾
Turning diameter	31.5 ft.	31.5 ft.
Brakes	Disks front, drums rear	Disks front & rear
Swept area	310 sq. in.	436 sq. in.
Curb weight	2,375 lb.	2,818 lb.
Price (as tested)	$3,598	$3,885

PERFORMANCE

	BMW 1800 TI	Rover 2000
0-60 m.p.h.	11.6 sec.	14.4 sec.
0-80 m.p.h.	20.5	27.0
40-60 m.p.h.	5.1	7.4
50-70 m.p.h.	7.0	10.1
SS ¼-mile	18.3	19.2
Fuel mileage	23.1 m.p.g.	26.3 m.p.g.



ROVER has glove compartments on both sides. They are as roomy as saddlebags and have padded fronts for kneecap protection.

BMW doors open to almost right angles and have uncommonly practical handles (to open—squeeze towards armrest).

Urheberrechtlich geschütztes Material

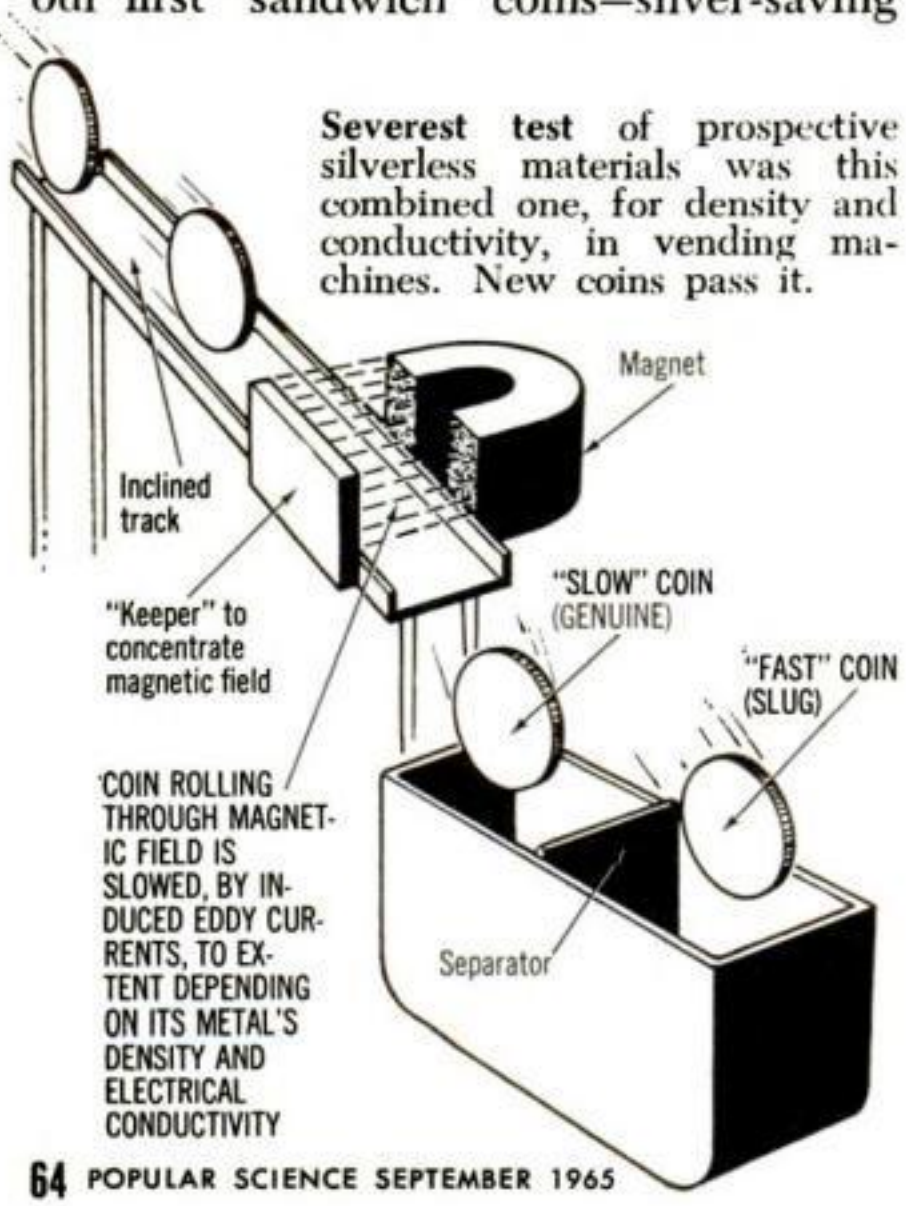
Experts find novel answer to biggest problem of the new coins you'll soon be using—making silverless dimes and quarters work in vending machines

By Alden P. Armagnac

The Inside Story of Our

IN YOUR change, early next year if not sooner, you'll notice a shiny new dime or quarter with a copper-colored pin-stripe around its edge.

And that will be your introduction to our first "sandwich" coins—silver-saving dimes, quarters, and half-dollars to replace the present silver ones. In size and design they'll be just like the current Roosevelt dime, Washington quarter, and Kennedy half-dollar—but their novel materials have no precedent among all the world's coins.


Magnet
Inclined track
"Keeper" to concentrate magnetic field
"SLOW" COIN (GENUINE)
"FAST" COIN (SLUG)
COIN ROLLING THROUGH MAGNETIC FIELD IS SLOWED, BY INDUCED EDDY CURRENTS, TO EXTENT DEPENDING ON ITS METAL'S DENSITY AND ELECTRICAL CONDUCTIVITY
Separator

Severest test of prospective silverless materials was this combined one, for density and conductivity, in vending machines. New coins pass it.

The new dime and quarter, both silverless, will outwardly be of white metal—its luster, slightly darker than silver, like a nickel's. That's because the outer layers will consist, as nickels do, of an alloy called "cupronickel"—three-fourths copper and one-fourth nickel. A pure-copper core between these faces, the sandwich's "filling," gives the reddish stripe at the edge.

The new half-dollar will be a three-layer coin, too, but with an all-white edge. Outside, it will be of a lustrous 80-percent-silver alloy; inside, of a still-white 21-percent-silver alloy. That will give it an overall silver content of 40 percent, against the 90 percent silver content of all present U. S. silver coins. (Both in new coins and old, the balance of coin-silver alloys consists of cop-

Urheberrechtlich geschütztes Material

New quarter (cutaway drawing) illustrates three-layer make-up of coming "sandwich" coins. They'll have same size and designs as present silver ones (right), but copper core will give new dimes and quarters a reddish stripe around edge.

New Silver-Saving Coins

per, which imparts desirable hardness.)

All these sandwich coins will be slightly lighter in weight than the silver ones jingling in your pocket. The new dime and quarter will resist wear better than silver ones. Their "ring" will not be quite as impressive, but the new half-dollar will have the "ring" of a high-silver coin.

The changes skip silver dollars, as none have been minted since 1935.

The why of the new coins is simple—there just isn't enough silver to go around. All the world's silver mines can't supply as much as is now consumed, either for coins or for other uses like jewelry, silverware, and photo film. Because of the world shortage of silver, most countries already have switched to silverless or reduced-silver coins. Now we must follow suit—for the Treasury's depleted silver stockpile wouldn't last three years at the rate it's shrinking.

How to make silver-saving coins has been under Treasury study for two years. The final answers came last February when the Battelle Memorial Institute, reporting on three months' intensive research for the Treasury, recommended the now-adopted sandwich coins.

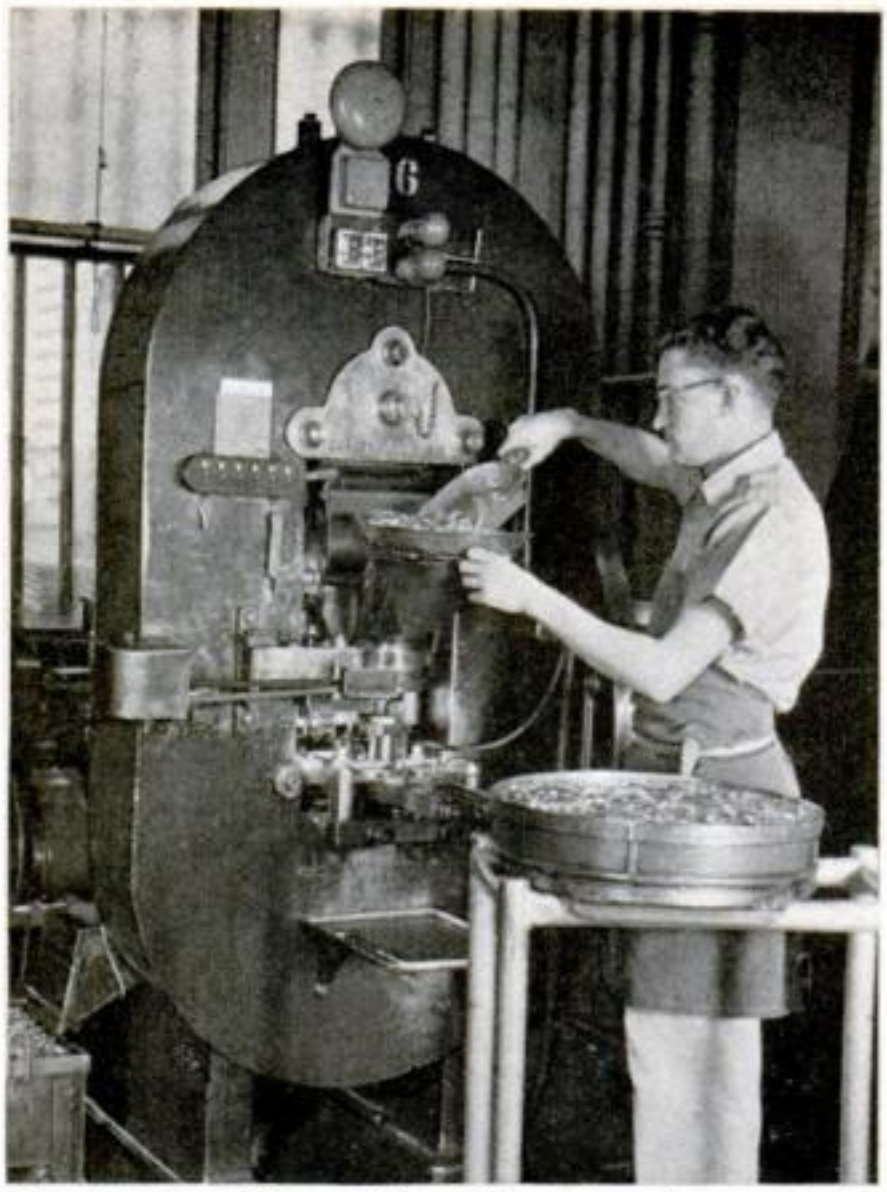
Behind their choice lay an engineering problem unique to this automated nation: Unaltered, our 12 million vending machines, pay phones, parking meters, and other coin-operated devices must accept the new coins as readily as the old. For the two-year-or-more job of altering all the machines would subject you and other users to intolerable inconvenience meanwhile, and disrupt a huge business (30 billion vending-machine purchases totaling $3½ billion, yearly).

This posed the strange task of devising silverless dimes and quarters that would fool vending machines into thinking they were silver. At the same time, the materials would have to meet needs

CONTINUED

Trial piece struck from new quarter's material used this fanciful "Virginia—1759—Martha Washington" design to simulate coin, as law bans such tests with dies in current use.

Urheberrechtlich geschütztes Material



New coins, like old, will come from U. S. mints' presses like this one. From round metal blanks, it makes two dimes, or one quarter or half-dollar, at each of 140 strokes a minute.

for use in coinage: attractive appearance, resistance to wear and corrosion, ability to take impressions, reasonable cost, ample supply.

Battelle experts considered metals actually used in the world's coins—copper, bronze, aluminum, nickel, cupronickel, "nickel silver" (copper-nickel-zinc), stainless steel—and exotic new ones, like columbium and zirconium. Quickly eliminated were some with really picturesque drawbacks.

Aluminum coins would be so lightweight as to cause "havoc," Battelle's report noted, when motorists tried to toss them into a toll-highway receptacle on a windy day. And widely available sheet aluminum takes impressions so readily that aluminum coins would be an invitation to counterfeiting.

As for cupronickel, the world's most widely used coin material, it would look odd for a dime-size coin of it to be worth more than a bigger nickel of the same alloy. Pure nickel (used for Canadian nickels) was out; a magnet attracts it. Even the simplest U. S. coin machines accept only coins that are the right size, and nonmagnetic.

Finally, every solid metal flunked the more-elaborate tests by which modern merchandise-vending machines reject washers, steel disks, play money, counterfeit coins, and cut-down pennies.

Besides checking a coin's size and nonmagnetic character, these sophisticated machines probe it for a hole with a "washer catcher," weigh it in a cradle, give it a "bounce test" for hardness, and apply a combined "eddy-current" test for density and conductivity that virtually identifies a coin's metal. Channels for different coins have separate eddy-current "rejectors," set to accept only coins of the right metal.

Sensitive as is this test, the Battelle researchers found a way to outwit it. The laminated cupronickel-copper makeup of the new dimes and quarters is taken for silver by the machines and accepted every time, trials show.

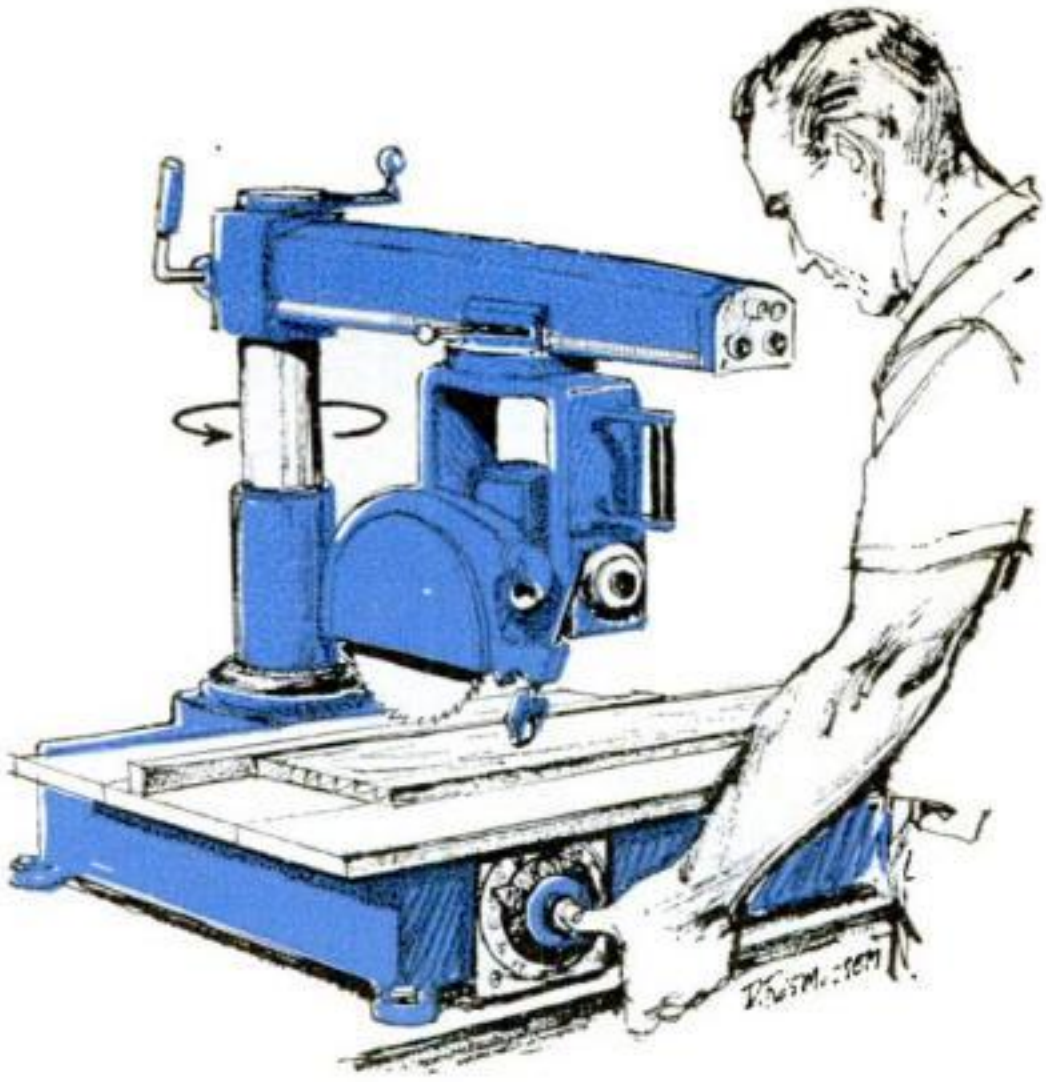
That solves the big vending-machine problem completely. There is no trouble with the new reduced-silver half-dollar; a coin with even as little as five percent of silver would pass the eddy-current test for silver. The reason for the new half-dollar's sandwich makeup is a different one—the easy tarnishing of its core's low-silver alloy, which would soon become unattractively mottled pink and yellow if used on the outside.

So few half-dollars are minted, compared with dimes and quarters, that the Treasury felt the new half-dollar could retain some silver—and thus "continue the 173-year-old tradition of American silver coinage"—without imperiling its silver-saving plans.

Taken together, the new coins will slash our use of silver for coinage by 90 percent. By law they'll be just as "good" and buy just as much as present ones, the President emphasizes. When you read this, they'll be in high-gear production—with 3½ billion of them due to be minted within a year, and either the new dime or quarter expected to be the first to appear in circulation. ■■

Urheberrechtlich geschütztes Material

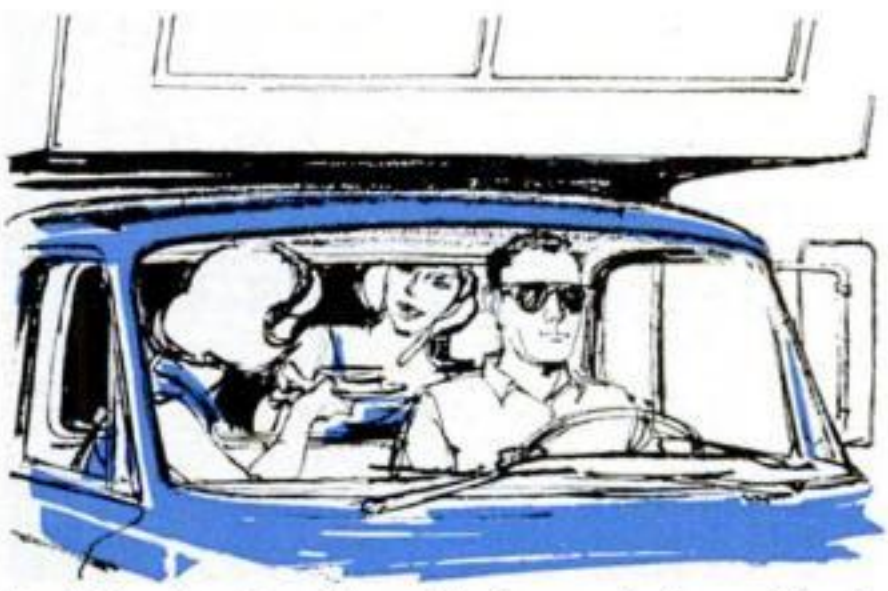
"I'd like to see them make..."



Radial-arm saws with adjustable stops. Pressing a button, like the tabulator key on a typewriter, would return the saw quickly to a preset mitering angle.—*S. Pass, Glendale, Calif.*

Stay-still sleeping bags with cloth loops at each side. By driving stakes through the loops, you could keep a bag from shifting while you slept. —*Ed Babinsky, Buffalo, N.Y.*

Protective wire terminals with flared ends. After a few bends where it leaves the ordinary terminal, wire often breaks. The flare would eliminate this.—*J. H. Hirrlinger, College Park, Md.*



A pickup truck with a roll-down window at back of the cab for campers. Then you could reach into the back while in motion, or talk to children there.—*G. M. Snow, Greenville, S.C.*

Disposable lawn nets you'd peg down where falling leaves gather heavily—just lift them and tie the corners. They'd be green colored, with a wide grid.—*R. Carlblom, San Marino, Calif.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What's *yours?* We pay $5 for each one published. Please use Government postcards only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 10017. Write your name and address clearly. Contributions cannot be acknowledged or returned.

Urheberrechtlich geschütztes Material

Coming...Ferries to Space

Re-usable launch vehicles, looking more like airplanes than rockets, will boost manned and unmanned craft into orbit

Models illustrate first stage and smaller second stage of the recoverable vehicle for space launchings that the author sees ahead.

By Dr. Wernher von Braun

Director of NASA's George C. Marshall Space Flight Center, Huntsville, Ala.

IN THE near future, we may expect to see spacecraft put into orbit in a new way.

Many of them will be borne aloft by winged and manned vehicles that resemble airplanes more than rockets—and that may even take off horizontally in airplane fashion, rather than vertically like rockets. The most important thing about these radical launch vehicles is that they will return safely to earth, to be used over and over again.

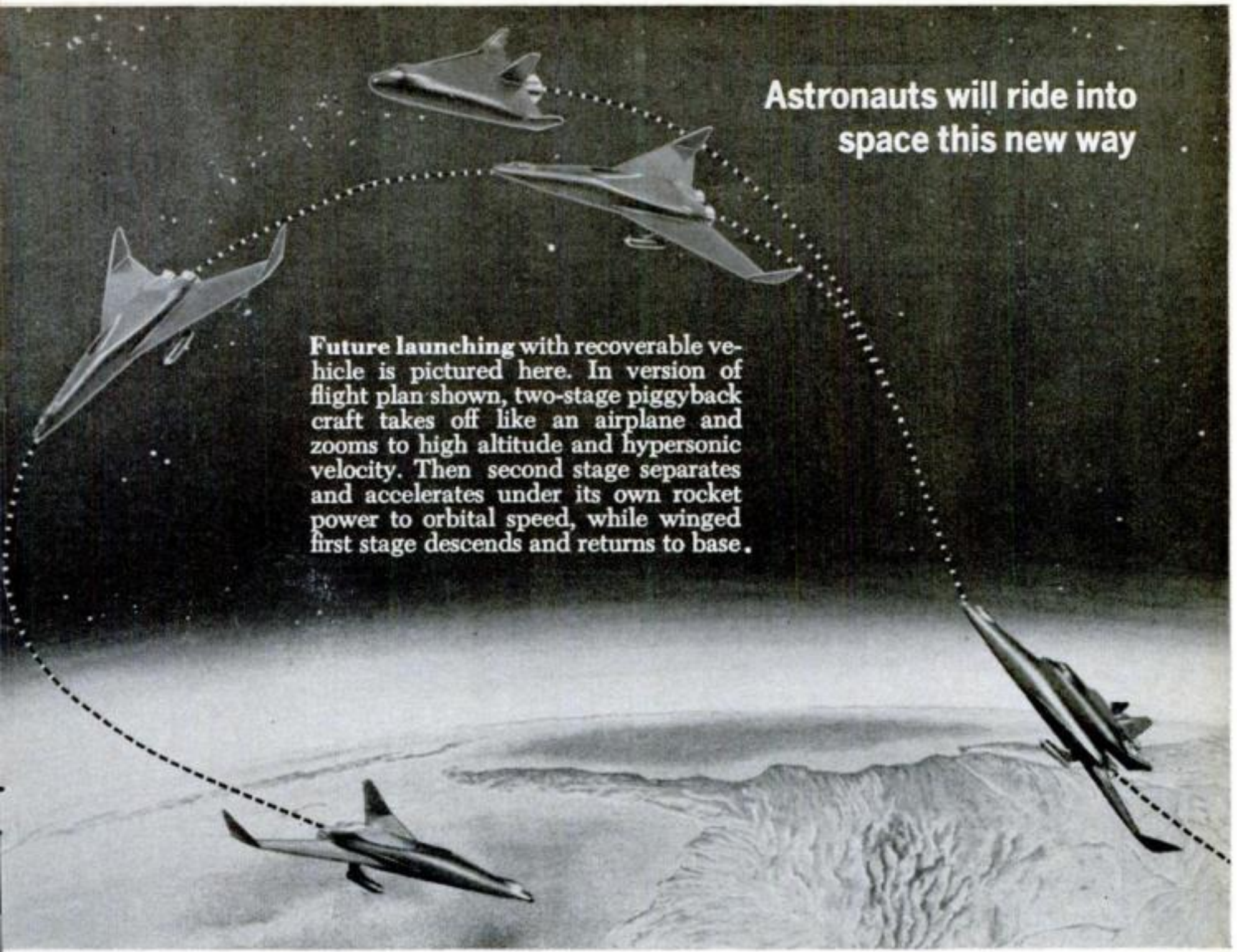
Dr. von Braun, right, attends a briefing at NASA's Manned Spacecraft Center in Houston with its director, Dr. Robert R. Gilruth.

Space flight today is still awfully expensive. Among the biggest items of cost, of course, are the large launch rockets required to hurl manned and unmanned spacecraft into orbit or beyond.

Up to now, all launch rockets have been strictly one-shot vehicles. Whether or not a spacecraft reaches its orbit and performs as expected, the launch vehicle is invariably consumed in the process.

Even with our most advanced launch vehicles, it still costs about $500 to send one pound of net payload into orbit. We must drastically reduce this cost if we are

Urheberrechtlich geschütztes Material


Astronauts will ride into space this new way
Future launching with recoverable vehicle is pictured here. In version of flight plan shown, two-stage piggyback craft takes off like an airplane and zooms to high altitude and hypersonic velocity. Then second stage separates and accelerates under its own rocket power to orbital speed, while winged first stage descends and returns to base.

to take full advantage of the tremendous potentials of space flight for scientific, commercial, and military purposes. Re-usable launch vehicles will provide a way.

Ferries to space. I think we can expect a re-usable launch vehicle to become available at some time between 1970 and 1975. We can expect such a vehicle to be capable of at least 50 to 100 flights to orbit. There is no reason why it could not make at least one flight weekly. Under these assumptions, we can expect the cost of orbital transportation to drop from the present $500 a pound to $50 a pound, or even less.

In my judgment, for reasons that I shall come to presently, the needs of a suitable design for the first generation of a re-usable launch vehicle point toward a manned craft that will be capable of carrying something like a dozen passengers, plus about five tons of cargo, into a low earth orbit.

What will it look like? Envision an aircraft the size of one of our big jet airliners. This is the first stage of the re-usable launch vehicle. Nestled on its back is the second stage—a smaller aircraft shaped like the space glider of the now defunct Dyna-Soar project, or one of the "lifting-body" configurations under current study. Both first and second stages are manned—the first stage with a flight crew, the second stage with a flight crew plus passengers, if any.

The first stage may be powered either with liquid-rocket engines or with supersonic turbojet engines. If rocket engines are used, it may take off vertically like one of our present-day space boosters—or it may be launched horizontally from a catapult. In the case of air-breathing engines, a catapult-type horizontal launch is mandatory.

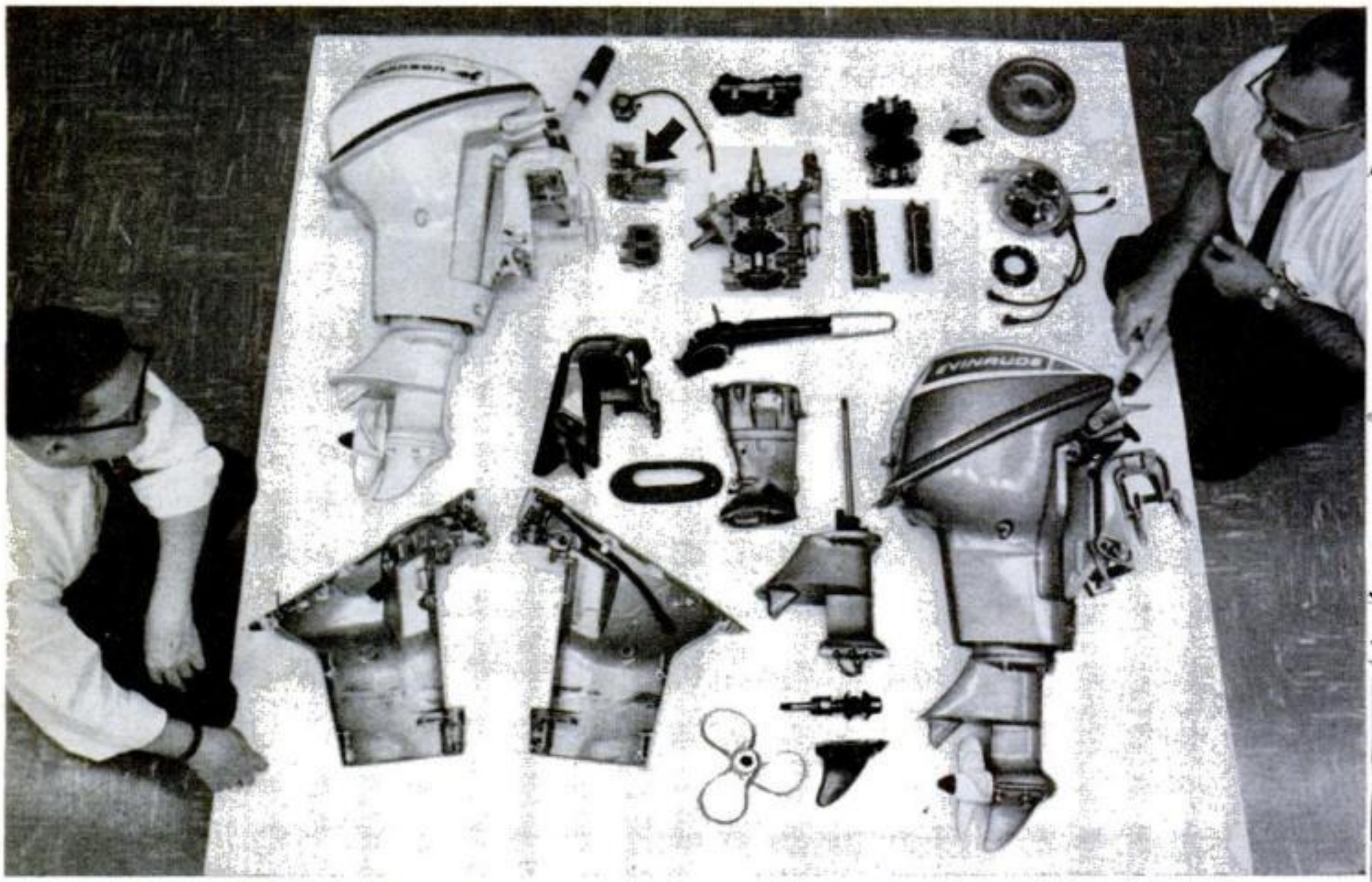
A rocket-powered first stage would ac-

[*Continued on page 206*]

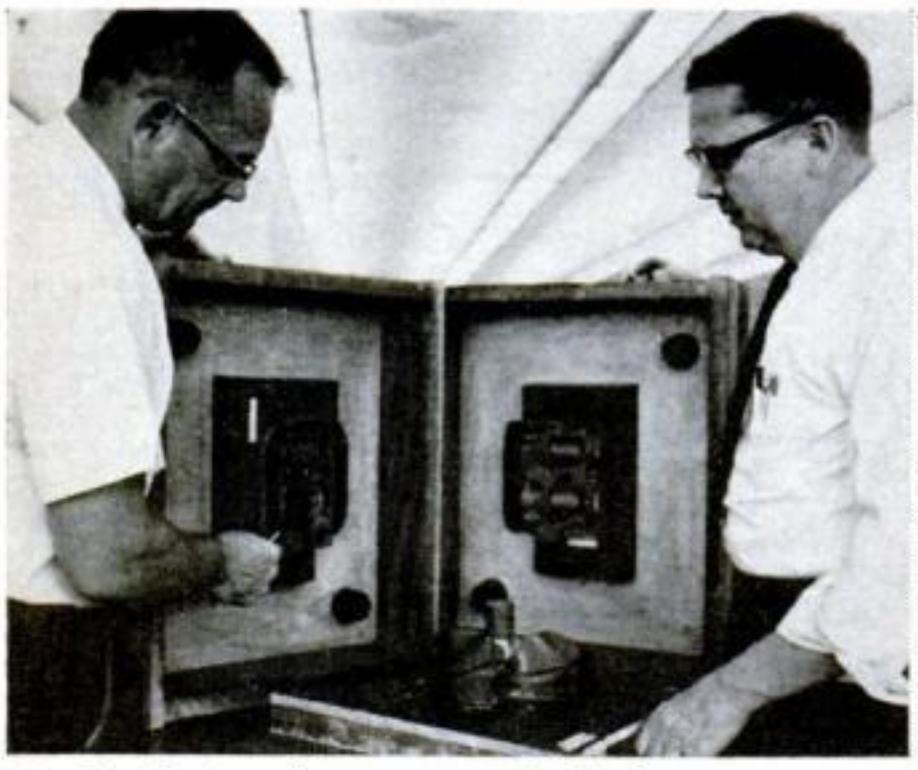
Urheberrechtlich geschütztes Material

How they built the—

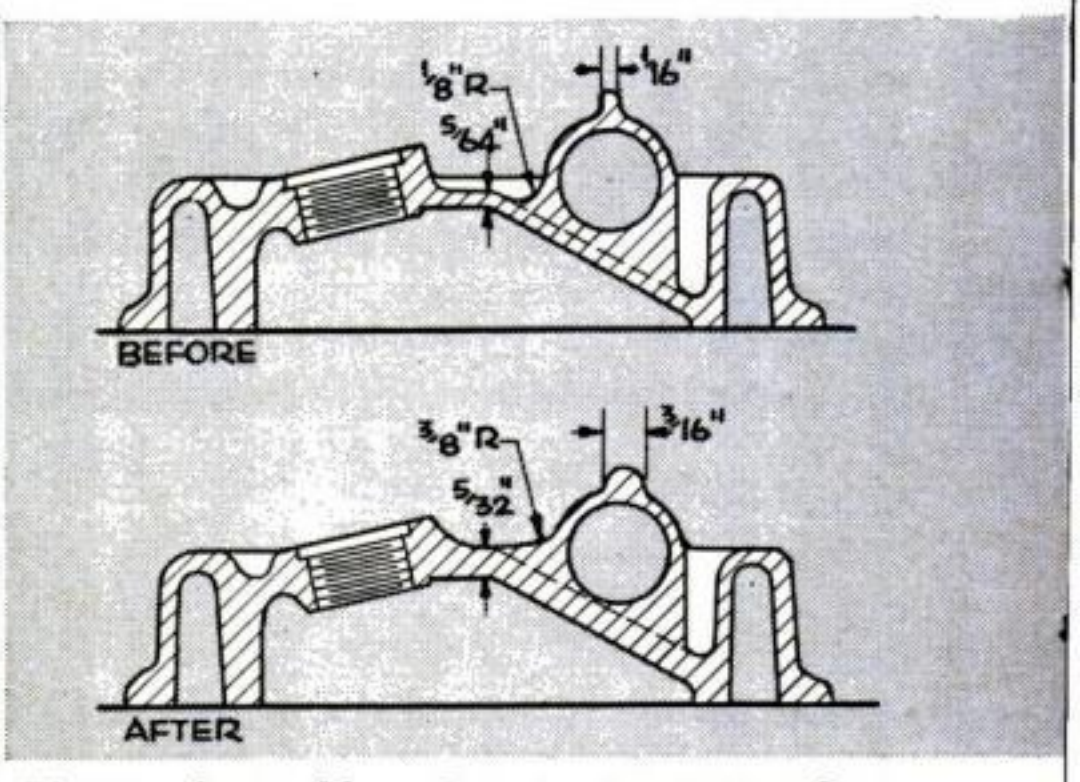
World's Best-Selling



Partially disassembled motor shows what makes the new 9½ tick. Principal secrets of this low-profile, lightweight motor are the side-mounted carburetor assembly, shown just above the center of the photograph, and the lighter-weight castings that are used throughout.



Newly designed parts are built from patterns such as these. Engineer Gene Rapplean points to a new gooseneck exhaust system. Specially designed drain collects fuel residue.



Picture of a problem: In extensive testing, heat around spark-plug bosses caused cylinder heads to crack. Solution: Increase dome thickness to 5/32 inch to dissipate heat more rapidly.

Urheberrechtlich geschütztes Material

Outboard

Light weight, low profile, and enough power to push a small boat briskly were the elusive objectives of a three-year engineering program

By Jim Roe

NOT one member of the slide-rule set would have been so brash as to predict—back in the summer of 1960—that they were designing the best-selling outboard motor in the world.

As they filled their scratch pads with do's, don't's, and doodles, they of course were aware that sales would be the ultimate proof of the pudding. But at this early stage in the game at the Marine Engineering Center of Outboard Marine Corp., all that the engineers had was a set of problems that needed to be transformed into opportunities.

If you like to take a "how-did-they-do-that" peek behind a job half as much as

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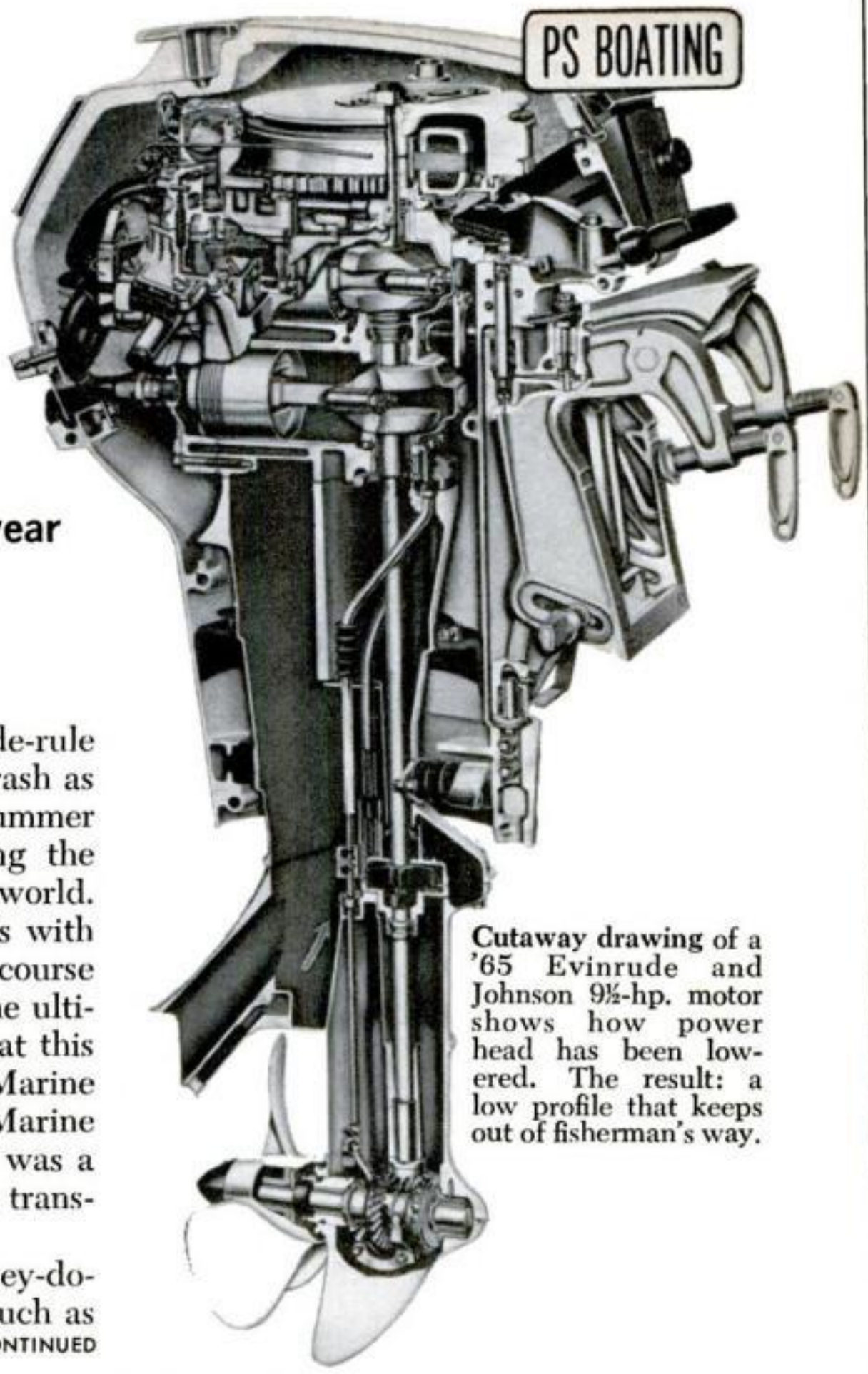
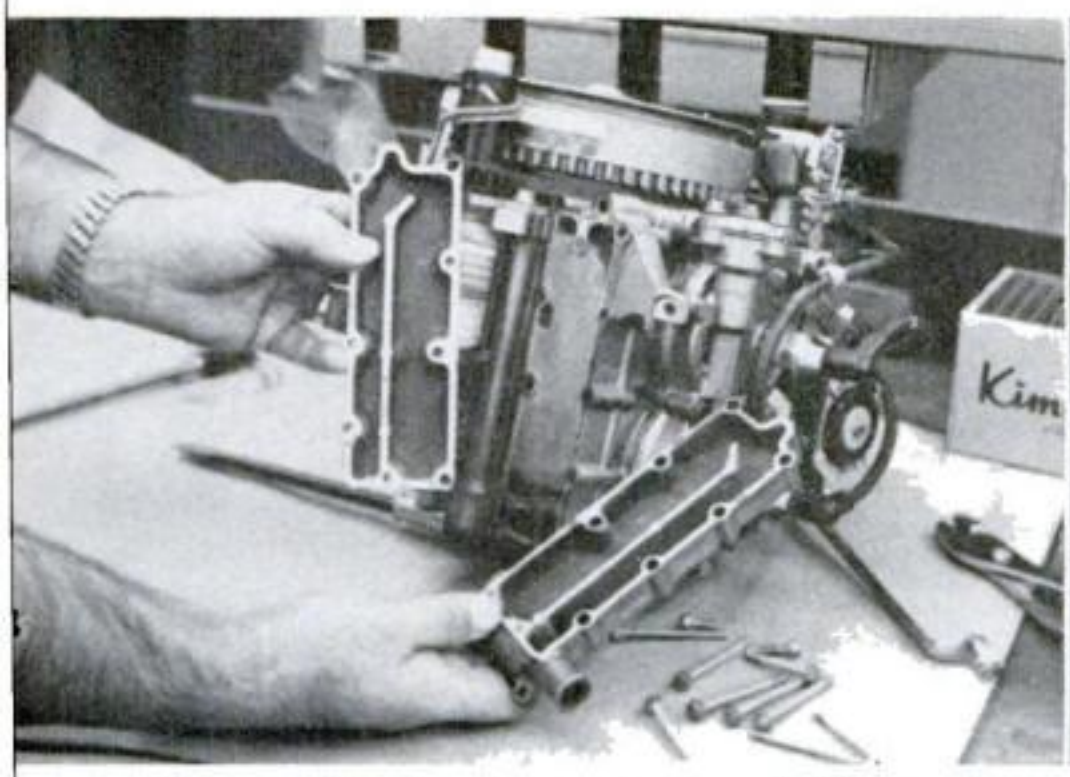
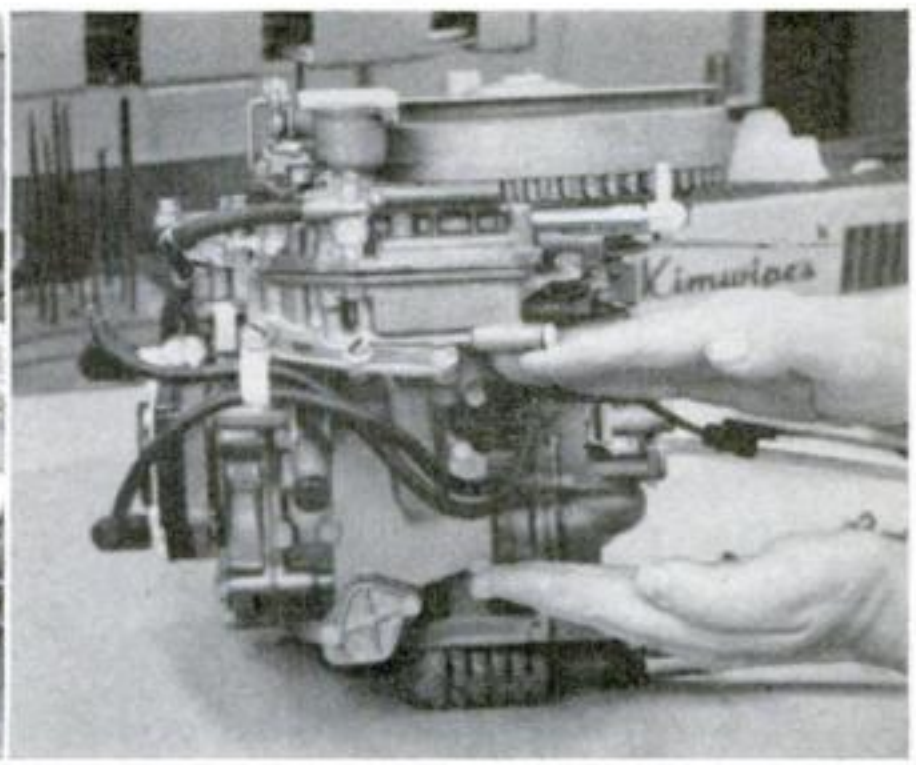


Cutaway drawing of a '65 Evinrude and Johnson 9½-hp. motor shows how power head has been lowered. The result: a low profile that keeps out of fisherman's way.



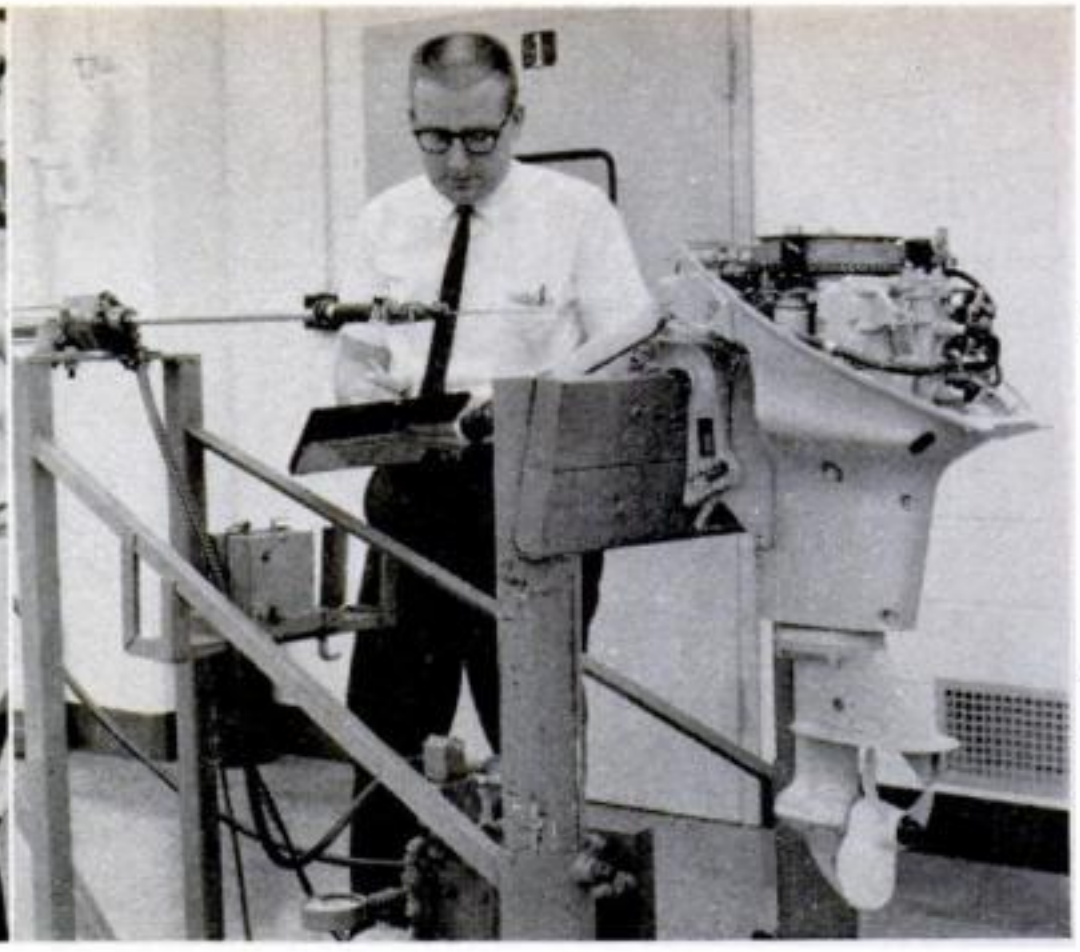
Gooseneck exhaust passage is part of more than 20 combinations of the new exhaust and idle-relief system tried before best one was found. Early designs had too much back pressure.



Side-mounted carburetor assembly saved several inches of height on new motor. This allowed engineers to place the power head so low that pistons actually operate below top of transom.

Urheberrechtlich geschütztes Material

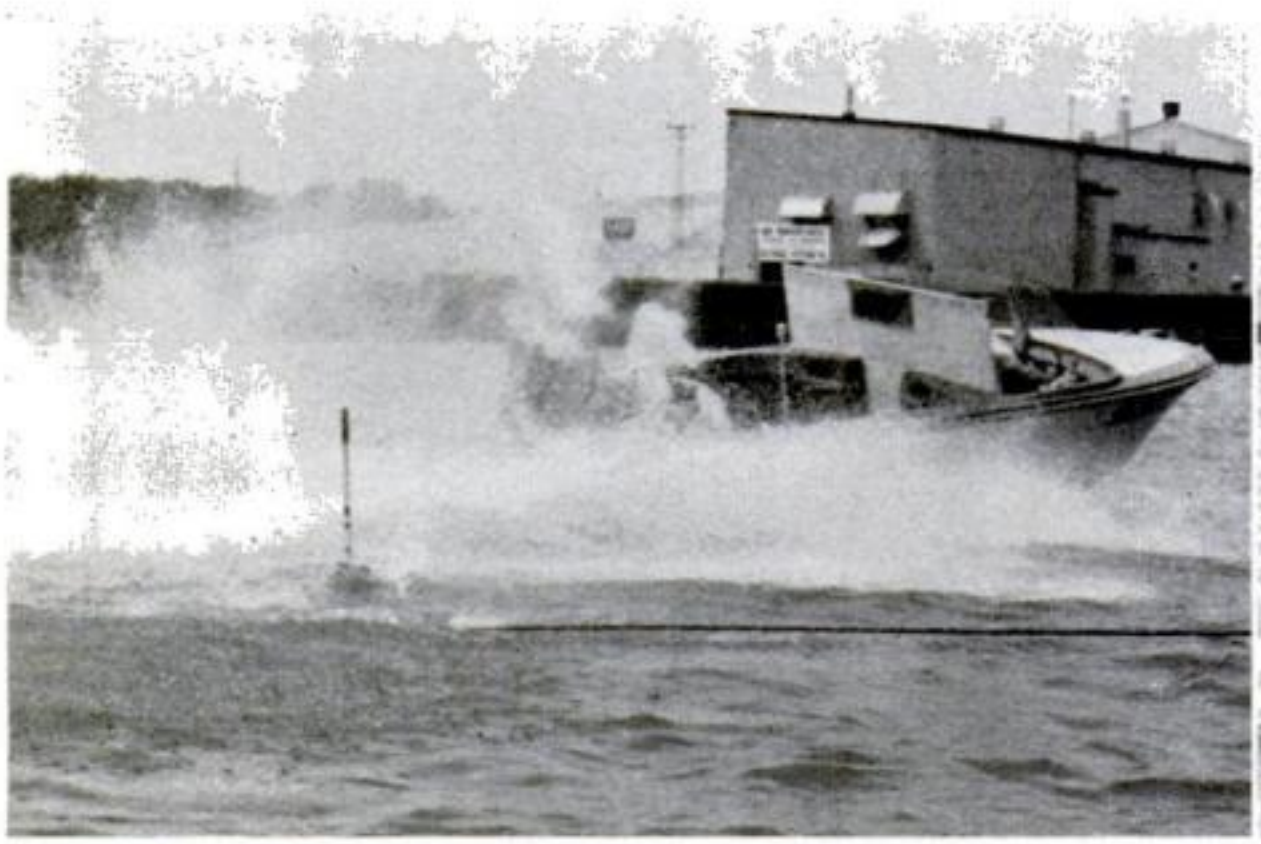
Prototype motors underwent in-the-water testing to check fuel consumption at different speeds. Tall column is visual-style fuel-flow meter; instrument on the seat is a tachometer.



Punishment to starters is this machine's specialty. Every outboard motor developed at OMC's Marine Engineering Center must withstand 20,000 starts with no part failure.

I do, you would have thoroughly enjoyed going along to Waukegan, Ill., and talking with the engineers who packed 9½ horses into a 34-inch, 60-pound package. This package was marketed as the new 9½-hp. outboard by both Johnson and Evinrude. And in the first year boatmen saw it, they made it the best-selling motor in the entire world.

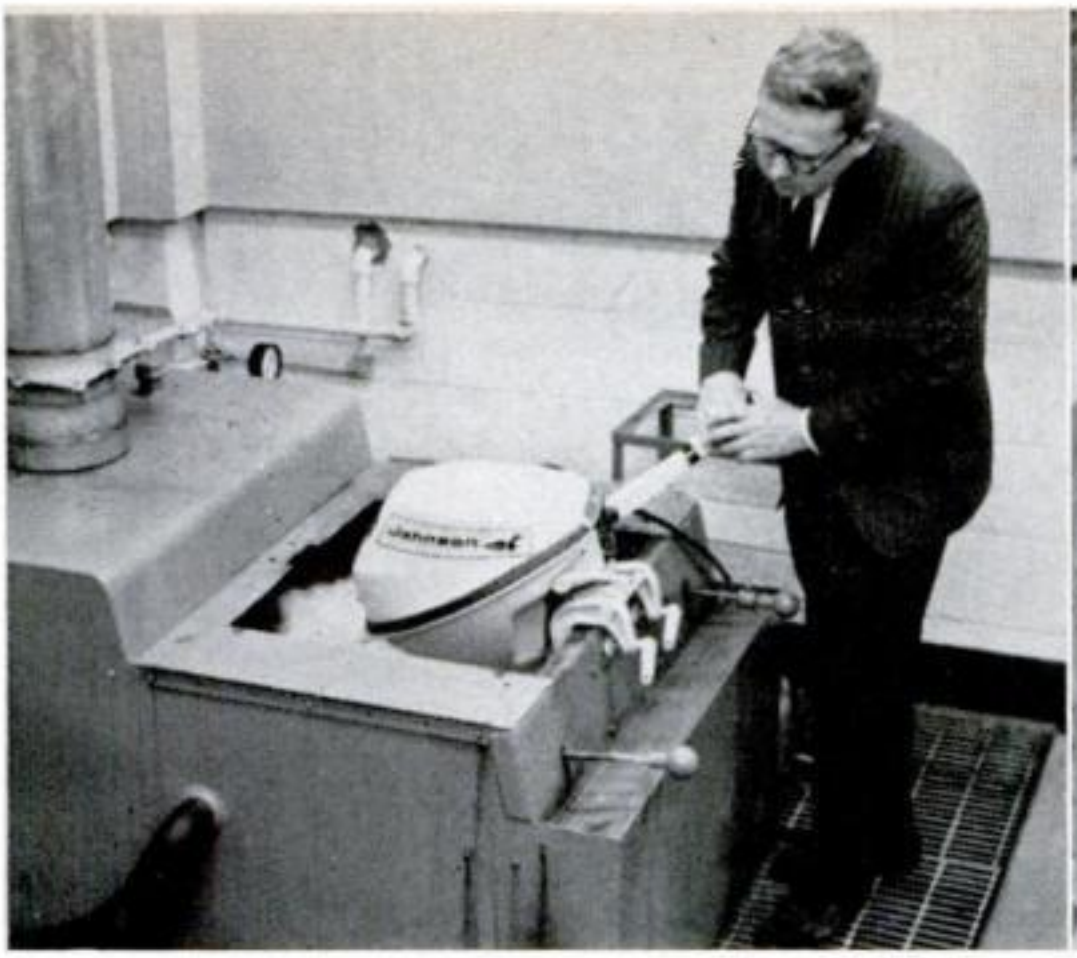
The target: small but spunky. The engineers had the ultimate objective in sight right from the start: They were out to achieve a "reduction of weight-to-horsepower ratio," which meant that they wanted a spunky, hard-working motor that was smaller and easier to handle. Designed especially for fishing boats, the motor would have to be completely portable, easy to handle, easy to mount and remove from boat transoms, work well on the widest possible variety of boats—and yet be handy to get in and out of



"Let's hit the log" test makes sure that lower units and automatic tilt-up systems can take it. Log is held submerged just beneath the water; the test boat goes over it at top speed.

What a difference: Previous year's 10-hp. motor mounted on boat at left looks like a sky-

Urheberrechtlich geschütztes Material



Tank testing is performed at both low and high temperatures. Test engines had to prove they could take it for at least 1,000 hours of hard work. This is equal to 10 years of normal use.

Broken flywheel didn't give up until it hit 18,800 r.p.m. A special test compartment of lead-lined steel holds the pieces as individual parts are tested until they eventually fail.

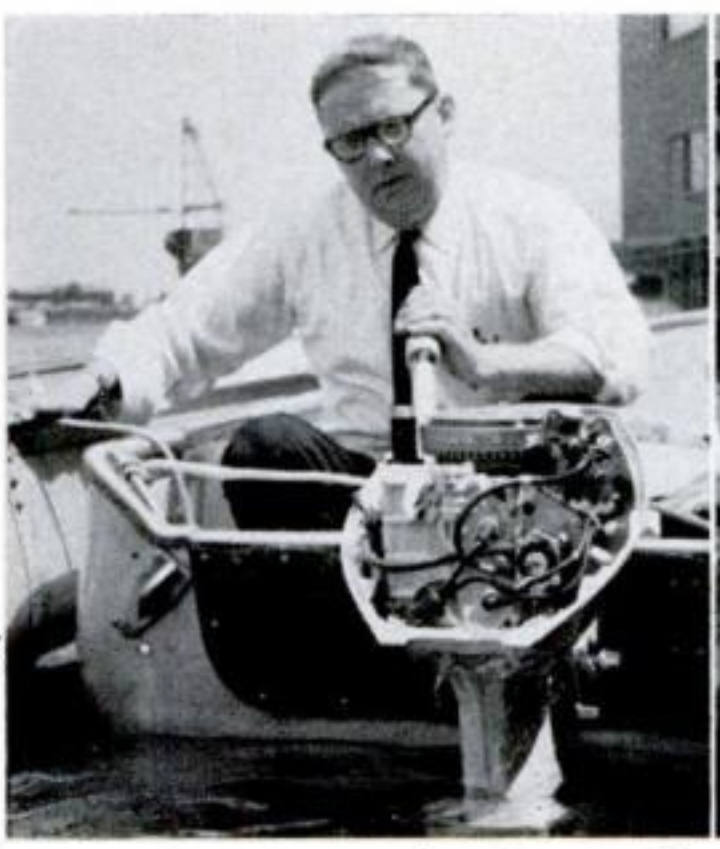
an auto trunk. And in that trunk, it had to be capable of being stored on its side without tipping out of position, and needed to be completely housebroken so it would not leak gasoline, oil, or water.

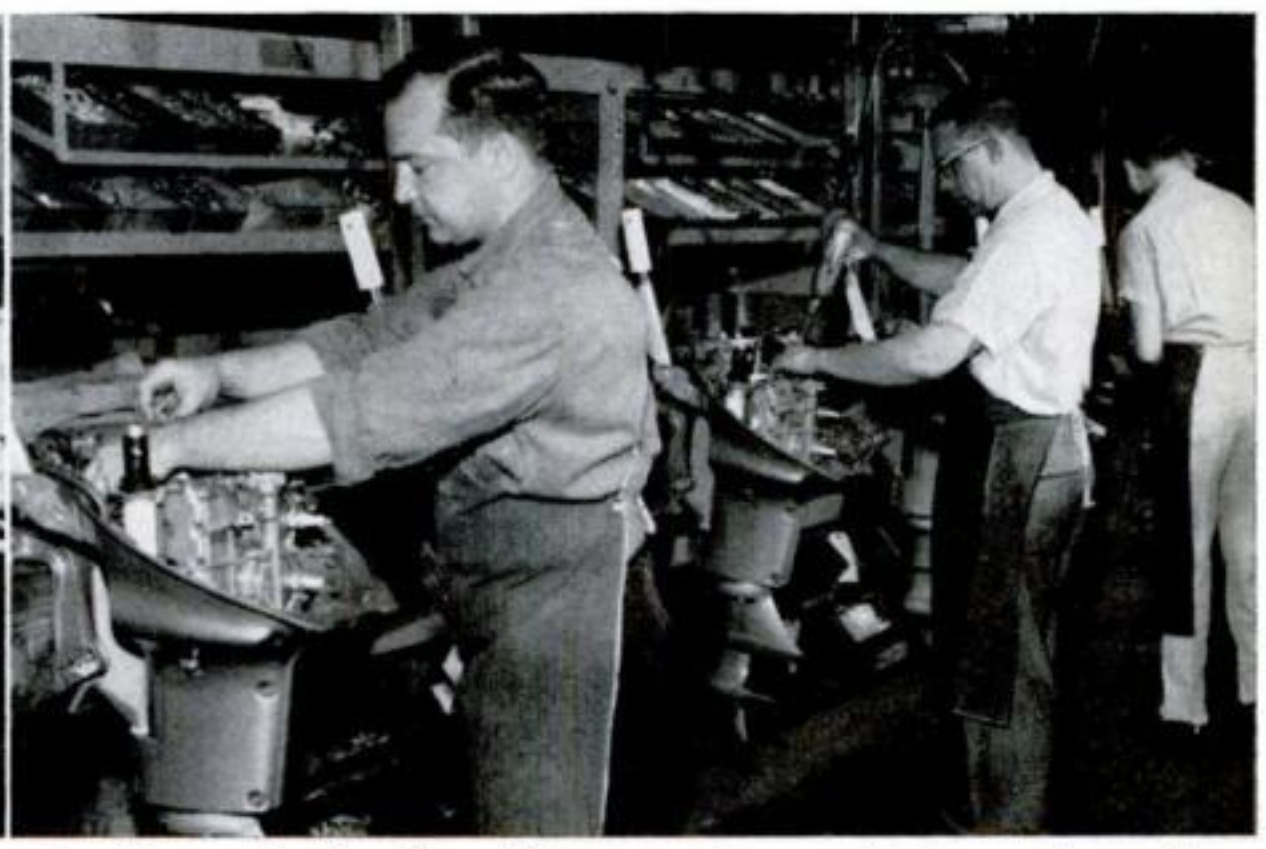
Adding the spunk. Now came the sweat. The engineers' standards also called for this motor to be able to run at least 1,000 hours at maximum speed and power with no major mechanical failures. It also had to run smoothly at any speed from 500 r.p.m. to its maximum 5,000.

A handy list of objectives. But how do you go about achieving all of them?

One of the first and biggest problems was lowering the profile—keeping all the horses on hand, but snugged so low to the transom that they would be well out of the way of the fisherman's fly rod. Obviously the carburetor had to go somewhere, since its normal mounting

[*Continued on page 202*]





scraper compared with new 9½ on boat at right. New motor weighs eight pounds less.

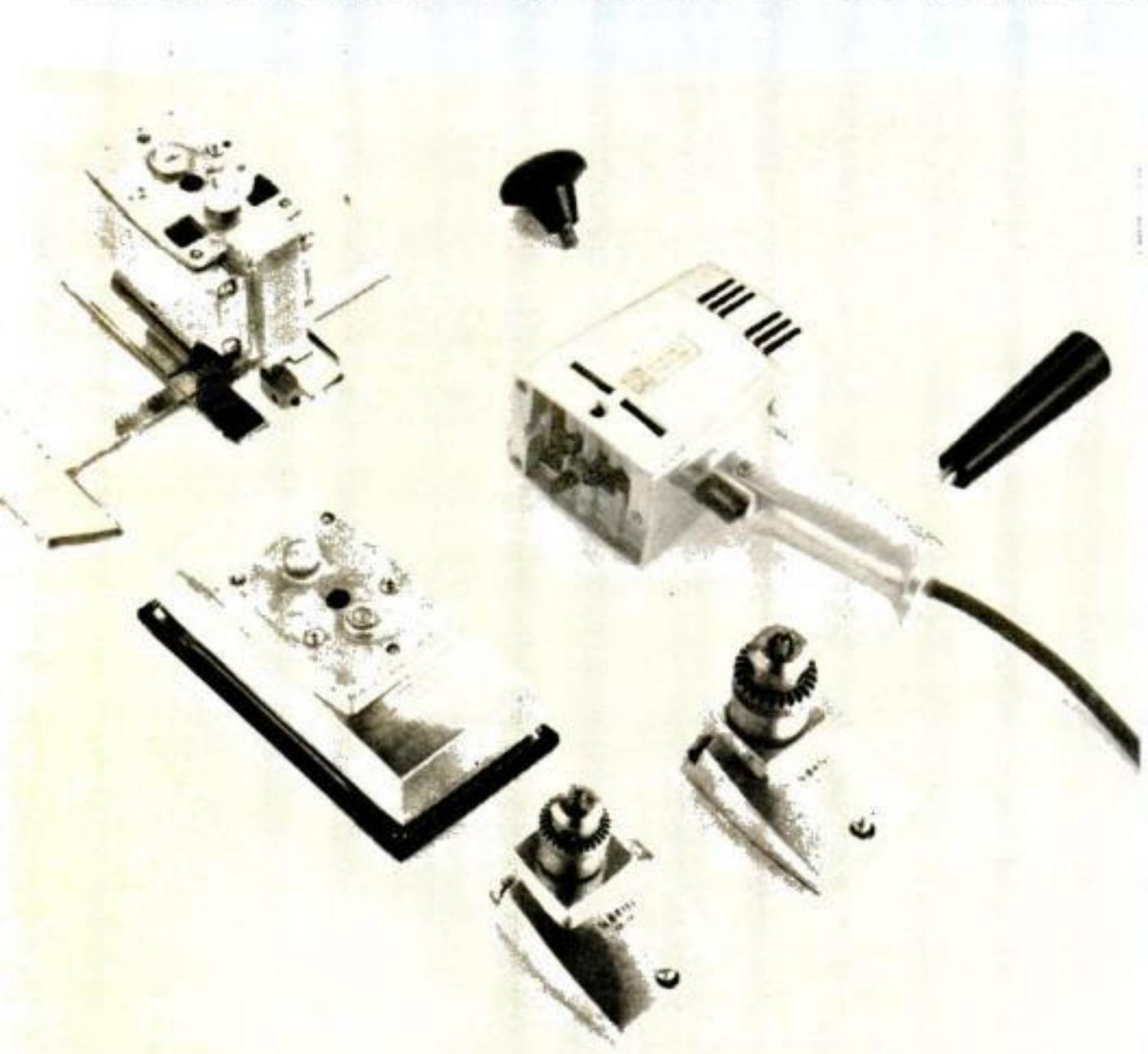
On the production line: No matter how well the engineers have done their job, no motor can become the world's largest seller unless each one performs just as well as the test models.

Urheberrechtlich geschütztes Material

One Motor—Four Tools

General Electric is breaking into the portable power-tool business with a husky ½-hp. unit that you can quickly hitch to any one of four interchangeable tool heads—¼-inch drill, ⅜-inch drill, saber saw, orbital sander. The tools in no way resemble the familiar power-drill attachments. Each combination is a properly geared and well-balanced tool.

It's a money-saver, too. You need only one motor. You can buy it with any of the tool heads ($18.98 with ¼-inch drill head,



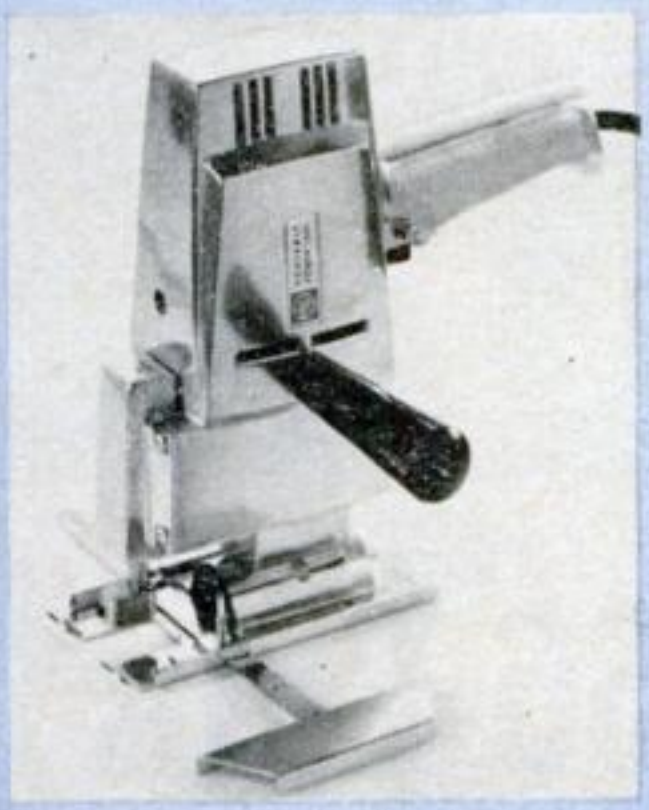
New GE family of convertible power tools runs off a single ½-hp. motor head that has enough muscle for the most demanding jobs. You can buy any one of the tool combinations—¼- or ⅜-inch drill, orbital sander, saber saw—and add any or all of the other tool heads later. The helper handles—stick and mushroom type—screw on in any of three locations.

Individually geared tool heads connect directly to the motor unit by three permanently attached screws. The gears mesh automatically.

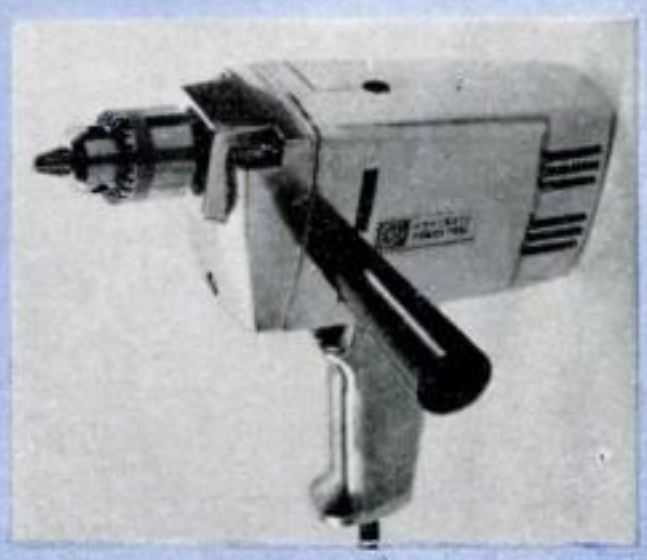
for example) and add others later. Price of the tool heads: ¼-inch drill, $6.98; ⅜-inch drill, $9.98; saber saw and orbital sander, $13.98 each. Or for $54.98 you can buy a complete portable workshop in a carrying case with power unit, three tool heads, and accessories.

In addition, GE is coming out with a separately powered 1¾-h.p., seven-inch circular saw for $37.98. The whole line will be available in October.

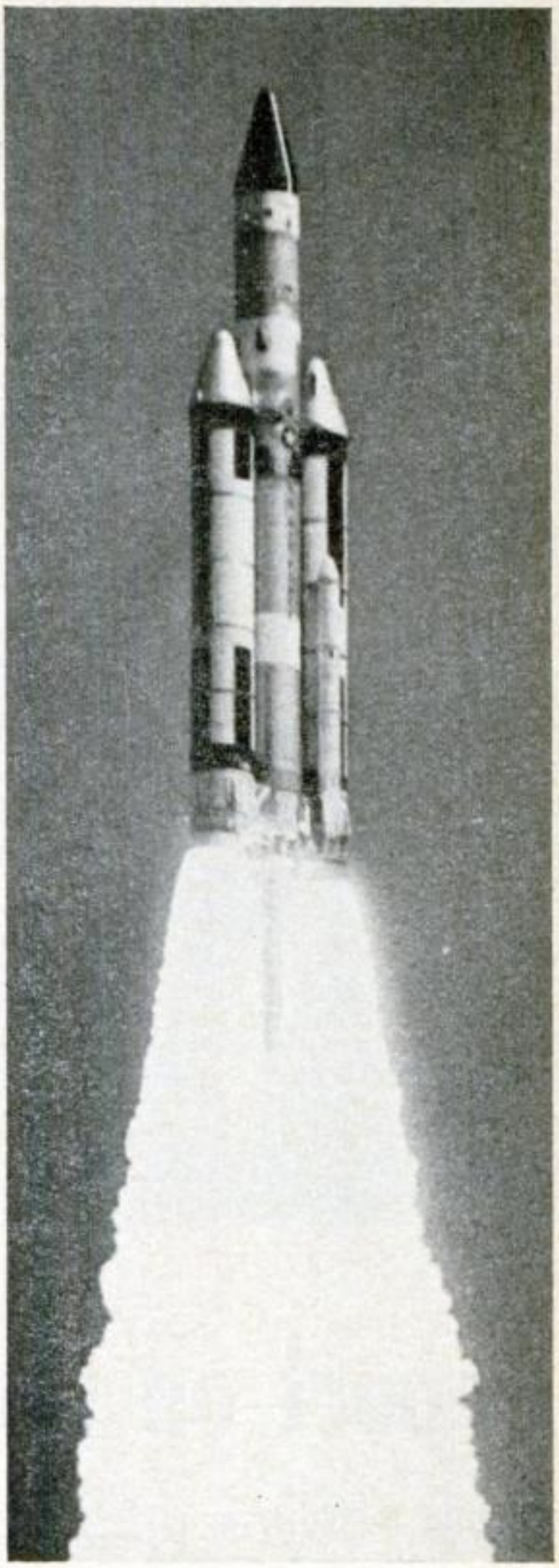
Sander works up flush to corners.



Saber saw cuts to front or sides.



Drill has two-stage gear reduction.

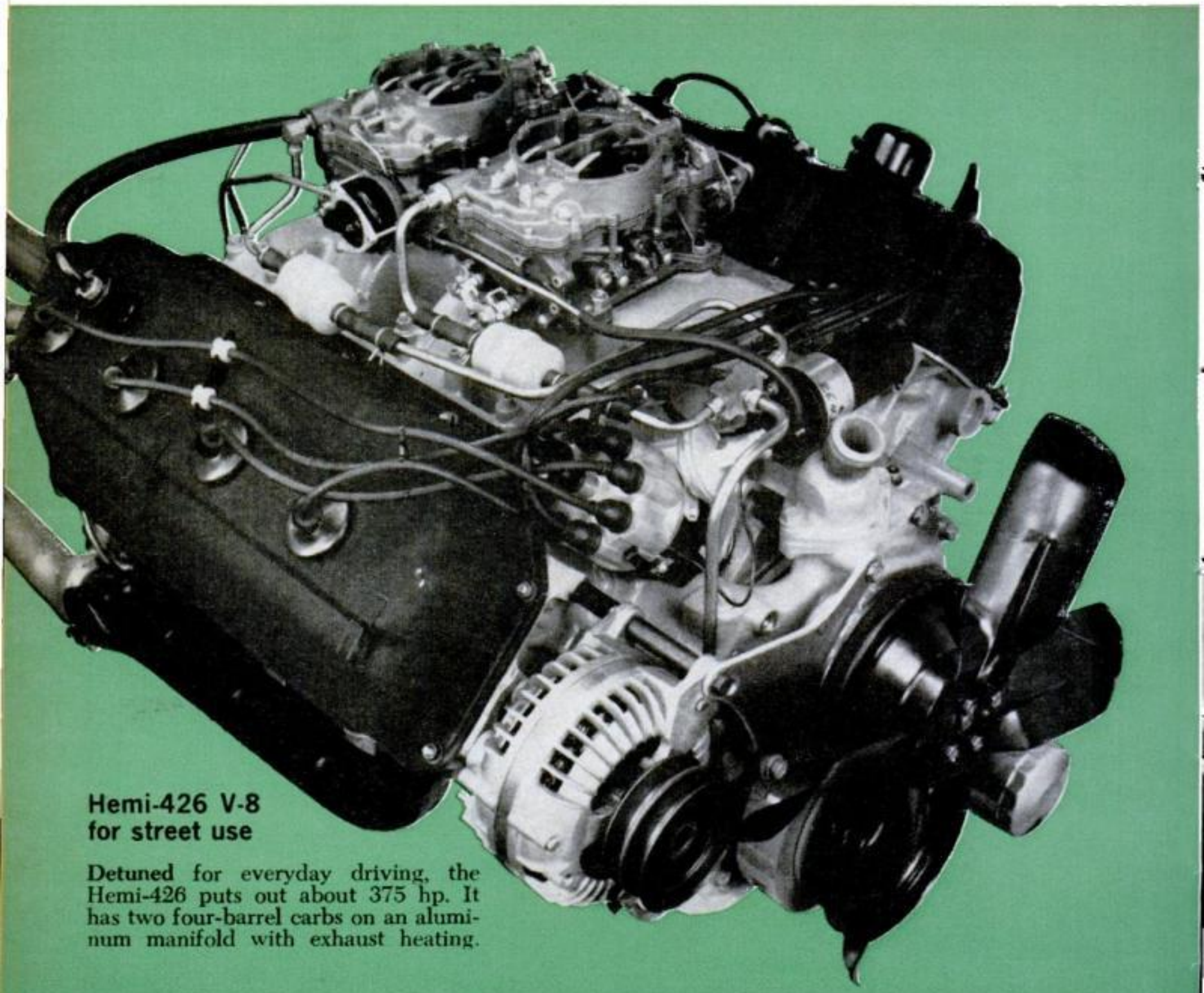


Mighty castle in the sky

At its Cape Kennedy blast-off, the Titan 3C, most powerful rocket ever launched in the free world, lifts off from its pad in its first flight. The 127-foot rocket successfully carried a 21,000-pound test load into orbit.

The rockets at its side are solid-propellant boosters. A bare two minutes after ignition, they burned out their 400 tons of propellant. The liquid core then took over its mission.

Urheberrechtlich geschütztes Material



Hemi-426 V-8 for street use

Detuned for everyday driving, the Hemi-426 puts out about 375 hp. It has two four-barrel carbs on an aluminum manifold with exhaust heating.

Report on the '66 Cars from

By Jan P. Norbye

WHEN the Chrysler Corp. 1966 cars come out, you may be more impressed by their engineering than by their styling. I was. I examined the new Plymouths, Dodges, and Chryslers and found many significant improvements and innovations:

- Belvedere and Coronet are available with a "street" version of the powerful hemi-head 426-cu.-in. V-8.
- The new standard engine for the Chrysler New Yorker and Imperial is a 440-cu.-in. wedge-head V-8.
- Tilt-and-telescope steering is available on the Fury, Polara, Chrysler, and Imperial.
- All models have a new power-steering pump that boosts assist for maneuvering.
- A rear heater-defroster unit is available on Dodge and Chrysler.
- Front disk brakes are available on

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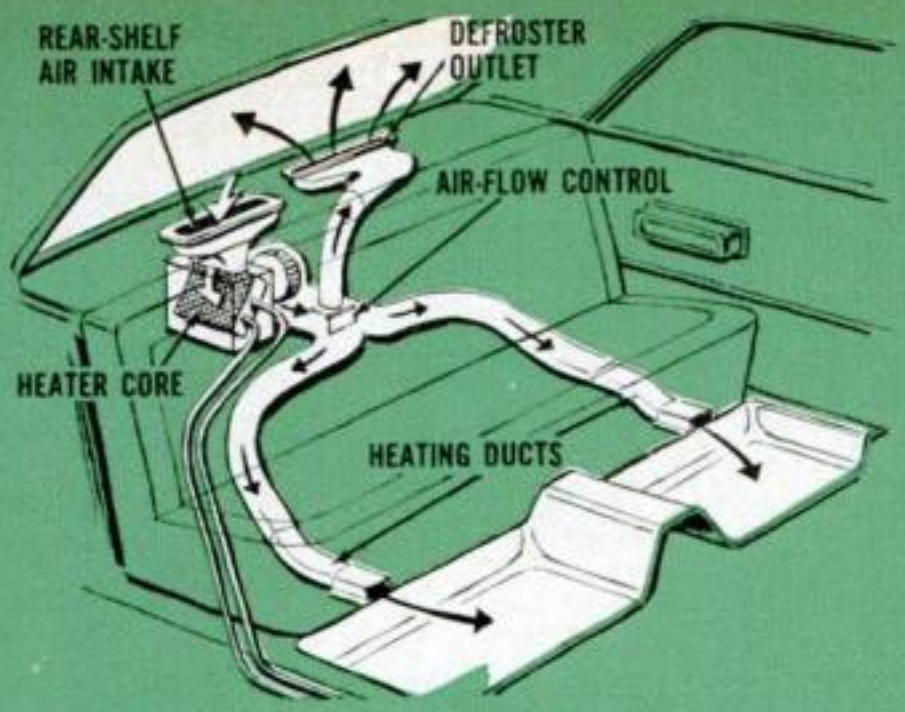
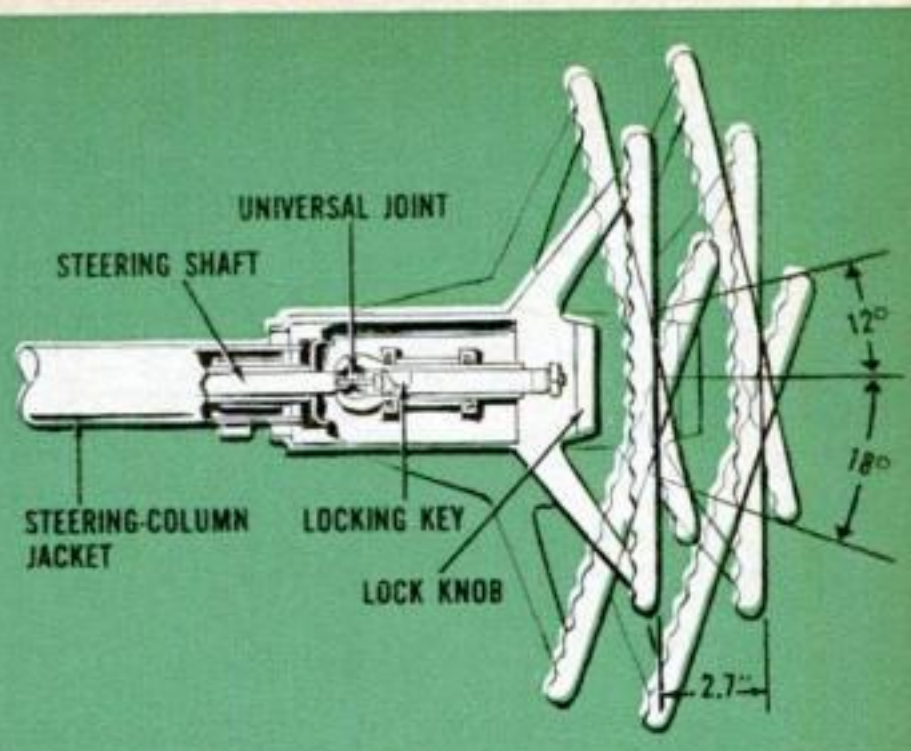
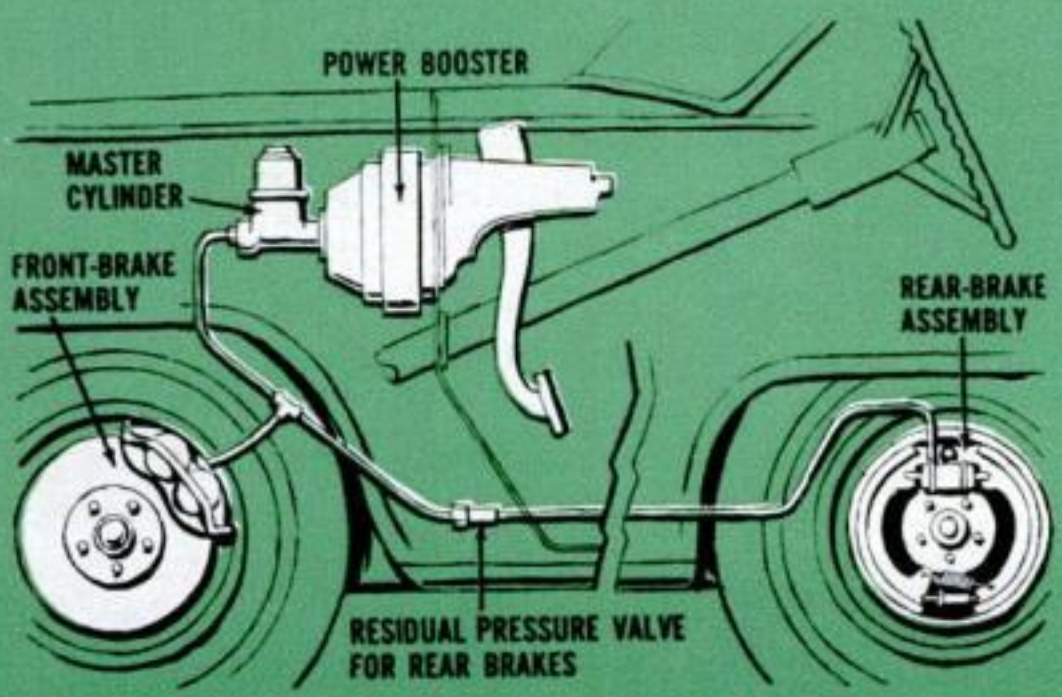


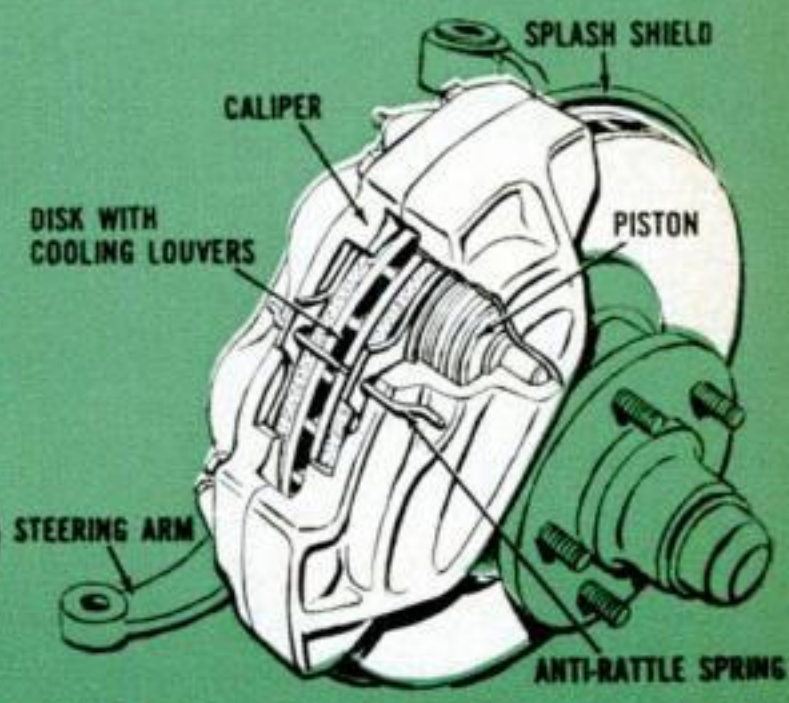
Better heating: Pipes in Chrysler lead from engine to separate heater core behind rear seat, with ducts to rear window and foot space.



Tilt-and-Tel steering wheel is easily adjustable. Small handle controls tilt; wheel hub locks and unlocks to adjust length of the column.



Front disk-brake installation on Dodge Polara includes residual pressure valve to keep rear wheels from locking. The disk is 11¾ inches



in diameter, has an anti-rattle bar between the friction-pad mounting plates and a splash shield inside (the wheel itself covers the outside).

Chrysler

PS Auto Editor reveals the inside story: a detuned Hemi-426 for street use, disk brakes (for compacts, too) . . . much more

Valiant, Barracuda, Dart, Fury, Polara, and Chrysler.

- Six-way power seats are available on all full-size models.
- Reclining passenger seats are available on all full-size models.
- All cars going to California have the "Cleaner-Air Package."
- Belvedere, Fury, Coronet, and Polara have new engine mounts that give better isolation and longer life.
- Engines are moved 1½ inches back in Belvedere and Coronet for better weight distribution.
- The TorqueFlite transmission has a new column shift linkage.
- The full-size bodies have improved door sealing, rattle-free glass attachment, safety door locks and handles.

Plymouth's Belvedere and Dodge's Coronet are billed as all-new cars. They share a new unit-construction body shell with a 116-inch wheelbase for the Belvedere and 117-inch wheelbase for the

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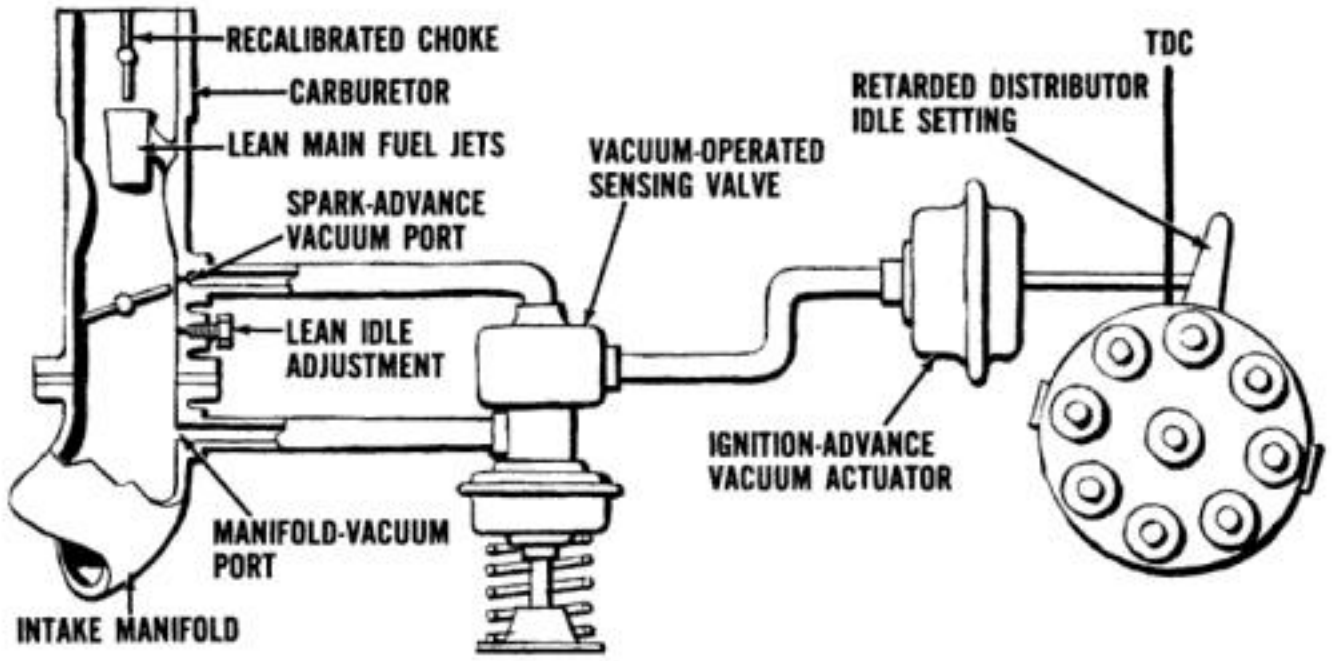


"Cleaner-Air Package" has modified carburetor, different distributor setting, and a sensing valve to control spark adjustment during deceleration. Result is less use of choke, leaner idle mixture. The main jets also operate closer to lean limit when cruising. Distributor has increased breaker-plate travel to get extra spark retard at idling speed.

Coronet. The outward appearance may be all new, but the drive trains and suspension systems are inherited from the 1965 models.

Muscle for the intermediates. You can get a hemi-head in the intermediate-size cars, which gives Chrysler some formidable entries against the "muscle cars" from General Motors (Tempest GTO, Olds 4-4-2, Skylark Gran Sport, Chevelle Malibu SS). The job of detuning the competition-type 426 V-8 for street use has been accomplished remarkably well. It's strong yet docile, well-silenced yet with a high-r.p.m. pitch that reveals its racing origin, and completely untemperamental with none of the unevenly pulsating V-8 throb of the Hemi-Charger and Super-Commando stock-car and drag-strip engines.

This has been achieved by lowering the compression ratio from 12.5 to 10.25:1. It has a softer camshaft that straightens out the torque curve and a new aluminum intake manifold with tandem-mounted carburetors and provision for using exhaust heat to speed engine warmup. The exhaust manifolds are modified for easier installation and servicing, and the dual-exhaust system is better muffled. Power output is about 375 hp. The standard intermediate-model engines are a 225-cu.-in., 145-hp. slant-six and a 273-cu.-in., 180-hp. V-8.

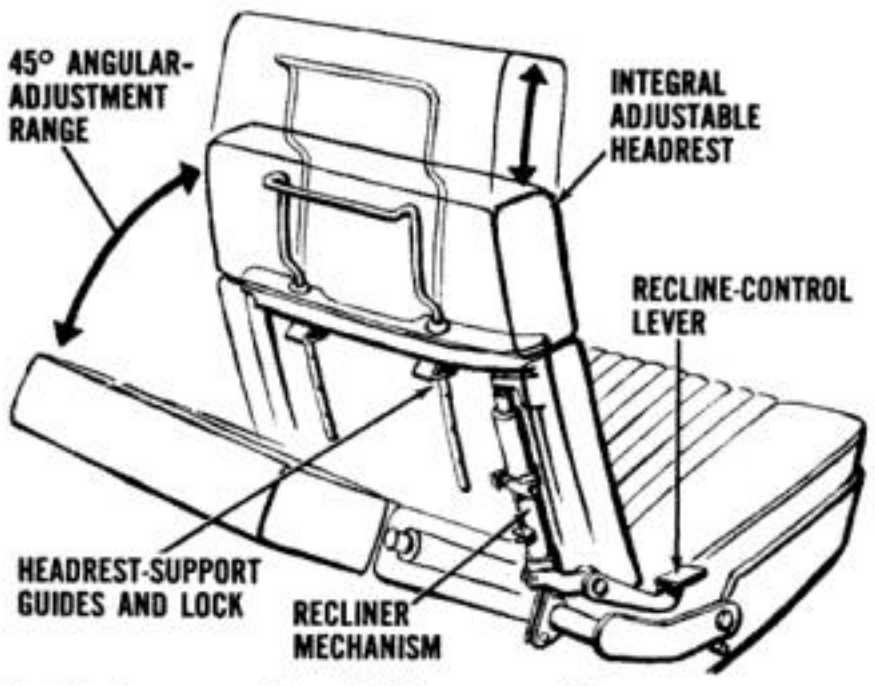
Moving all engines 1½ inches towards the passenger compartment has been accomplished without noticeable loss of leg room. Reducing the forward weight bias lowers the polar moment of inertia, which speeds up steering response and improves handling precision.

(A car with a high polar moment of inertia resists all forces trying to deflect it from a straight path; a low polar moment of inertia makes it easier to change a car's direction. The distance between the car's center of rotation and its center of gravity determines polar moment of inertia.)

Engine mounts are new, and the front mounting points have been lowered and moved closer to the block center line. This gives the engine greater freedom from vibration, and the mounts are tuned to counteract the transfer of both engine and suspension vibrations to the body structure.

High-speed suspension systems. Regardless of your choice of model, engine, and transmission, you would do well to try out the Rally Suspension. It is actually the heavy-duty-suspension kit specified for police cars and used by

[*Continued on page 172*]



Reclining seat has 45-degree adjustment range. The mechanism is spring-loaded to bring backrest forward—you lean back against spring load.

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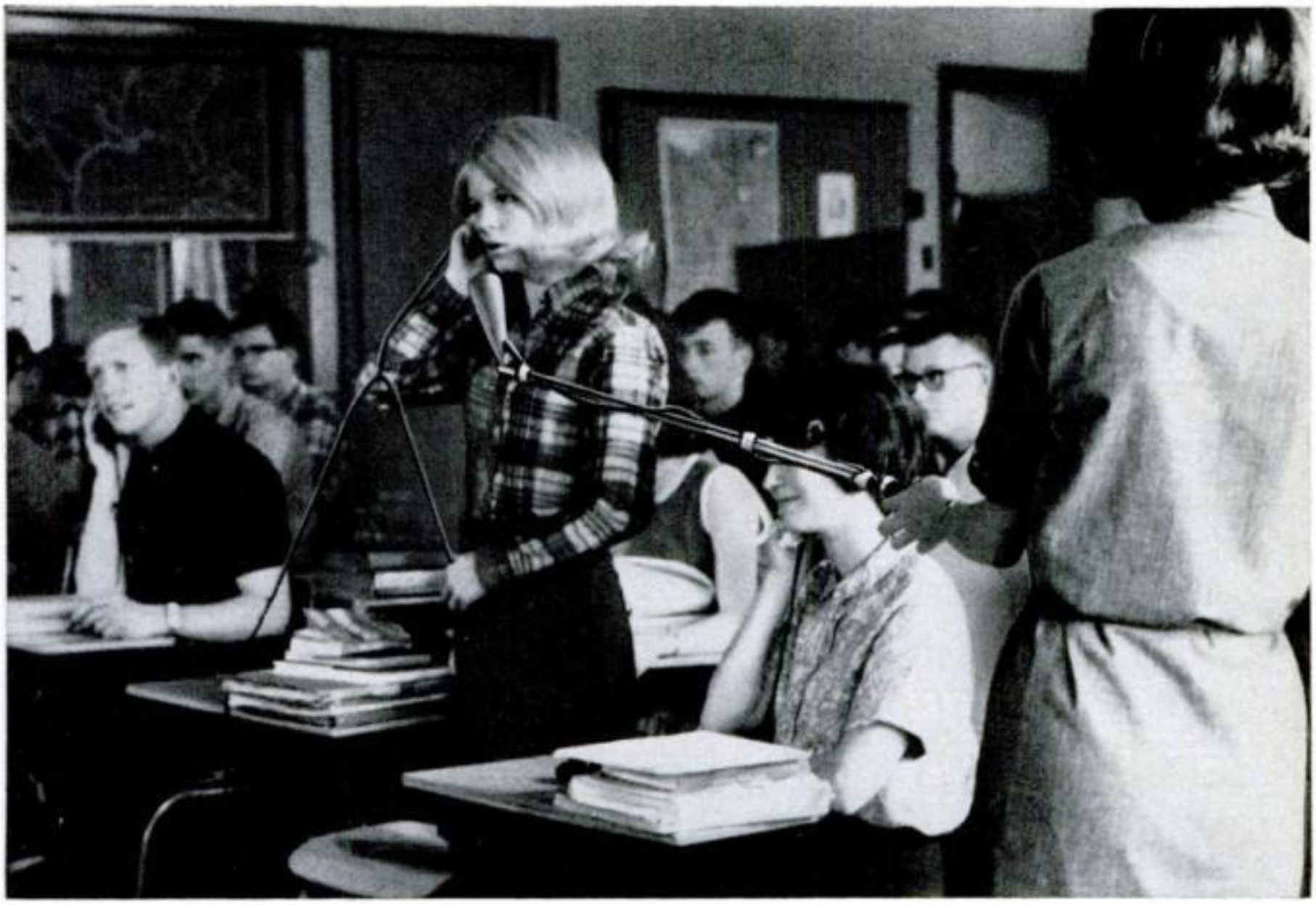


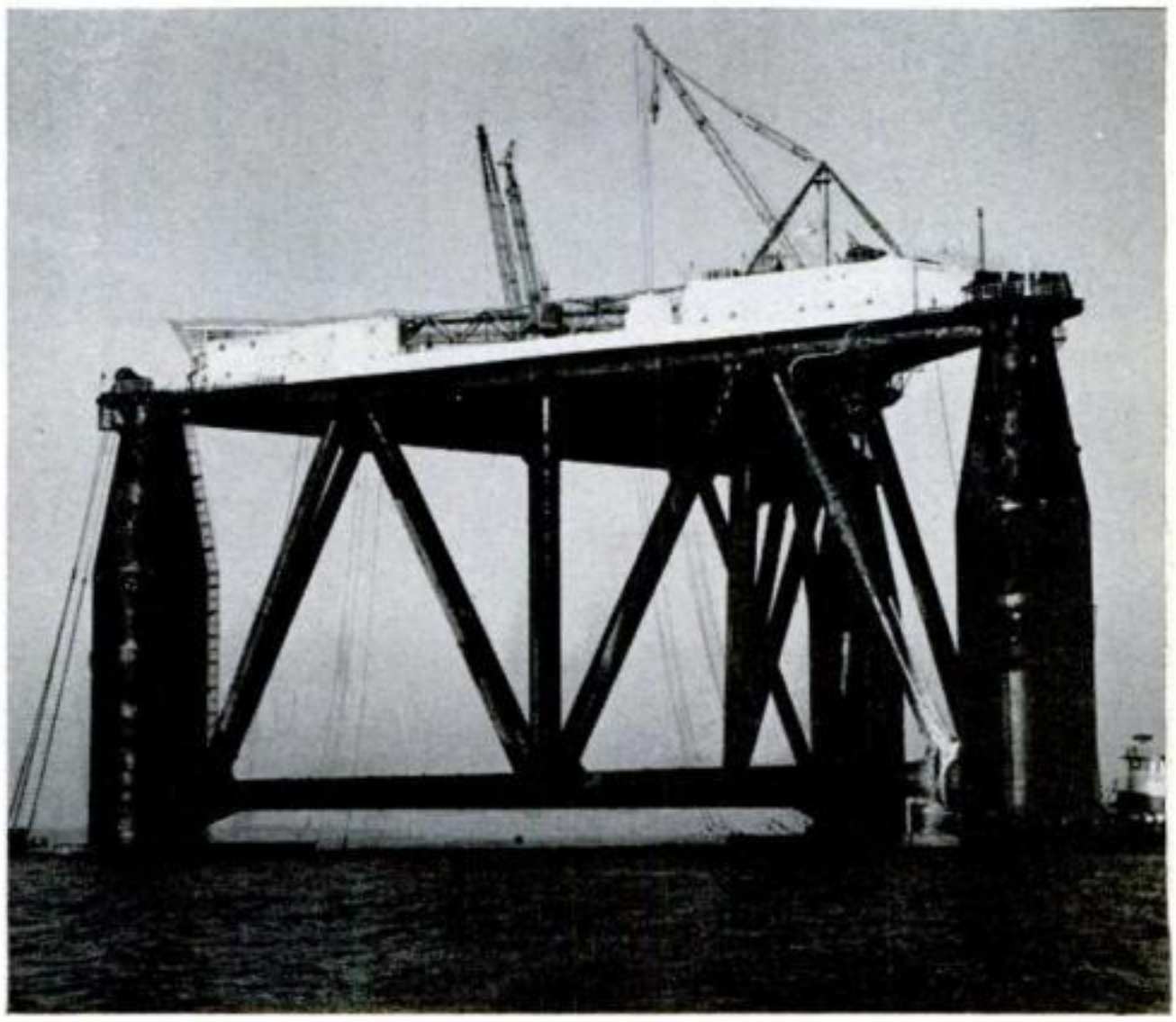
French-American schools hold joint session by satellite

One of the first educational jobs done by the Early Bird communications satellite was to connect West Bend (Wis.) High School by television and phone with the Lycée Henri IV in Paris for a joint session. Here one of the U. S. students talks by phone (via satellite) to one of the pupils in the French high school.

Biggest offshore rig drills for oil in Gulf

World's largest oil-drilling rig, the acre-size floating structure pictured at right is more than 30 stories tall. The 9,000-ton triangular steel island was built by Litton Industries for Pan-American Petroleum Corp. to drill for oil in the Gulf of Mexico.

It carries a crew of 52 men, is equipped with galley, mess hall, sick bay, and recreational facilities.



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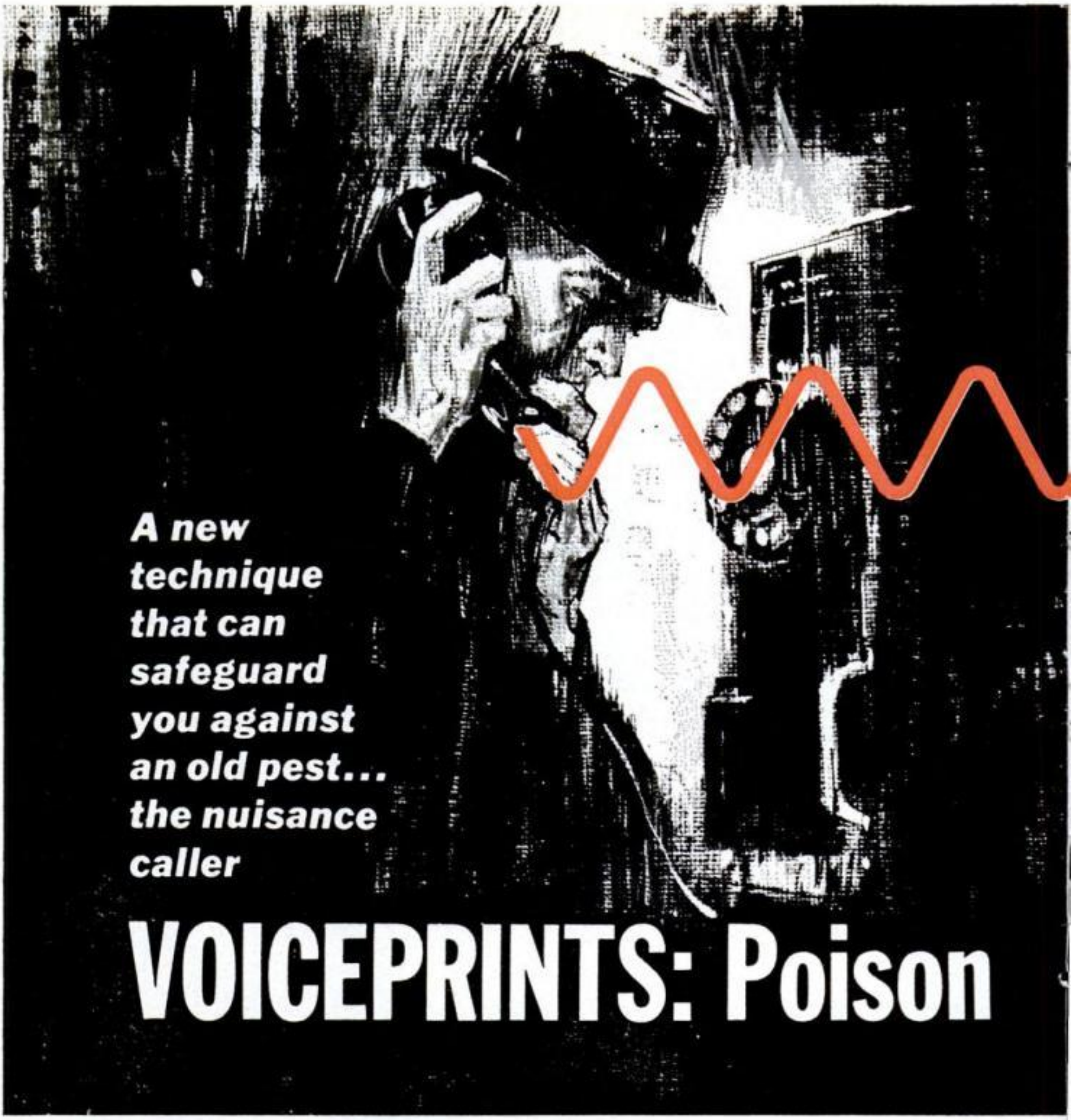
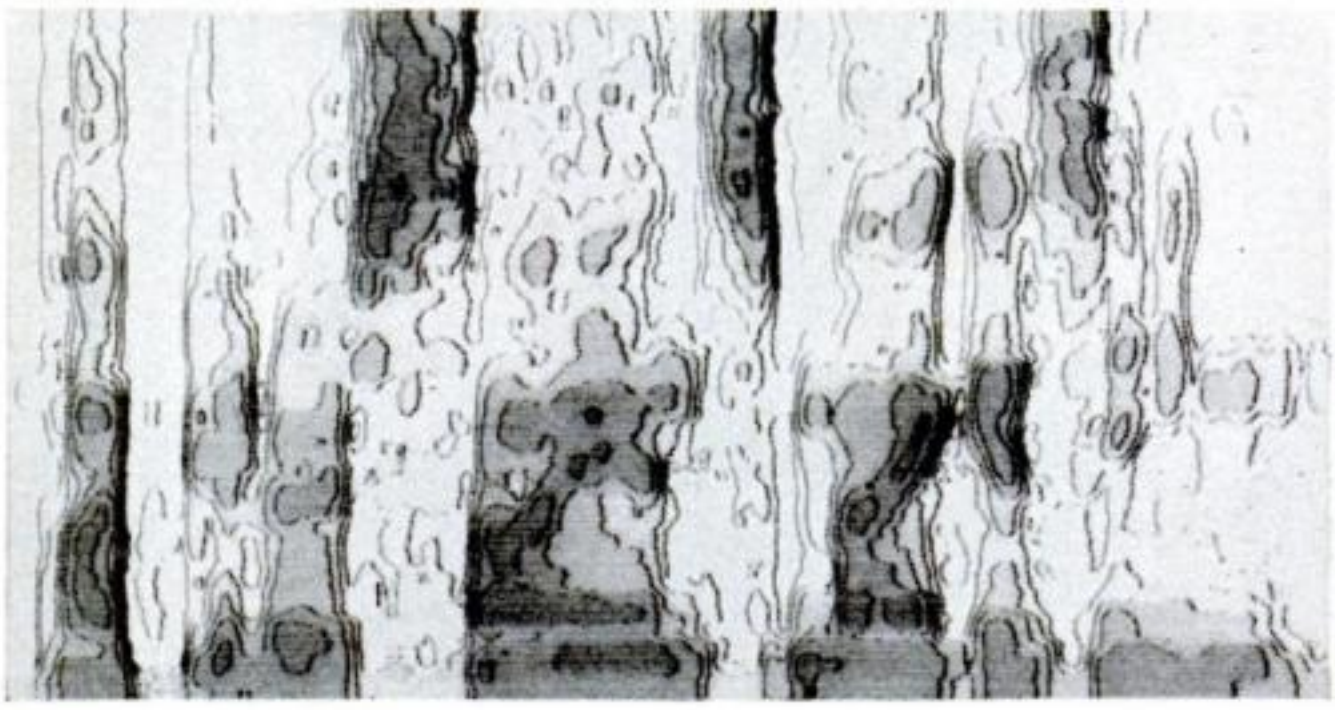


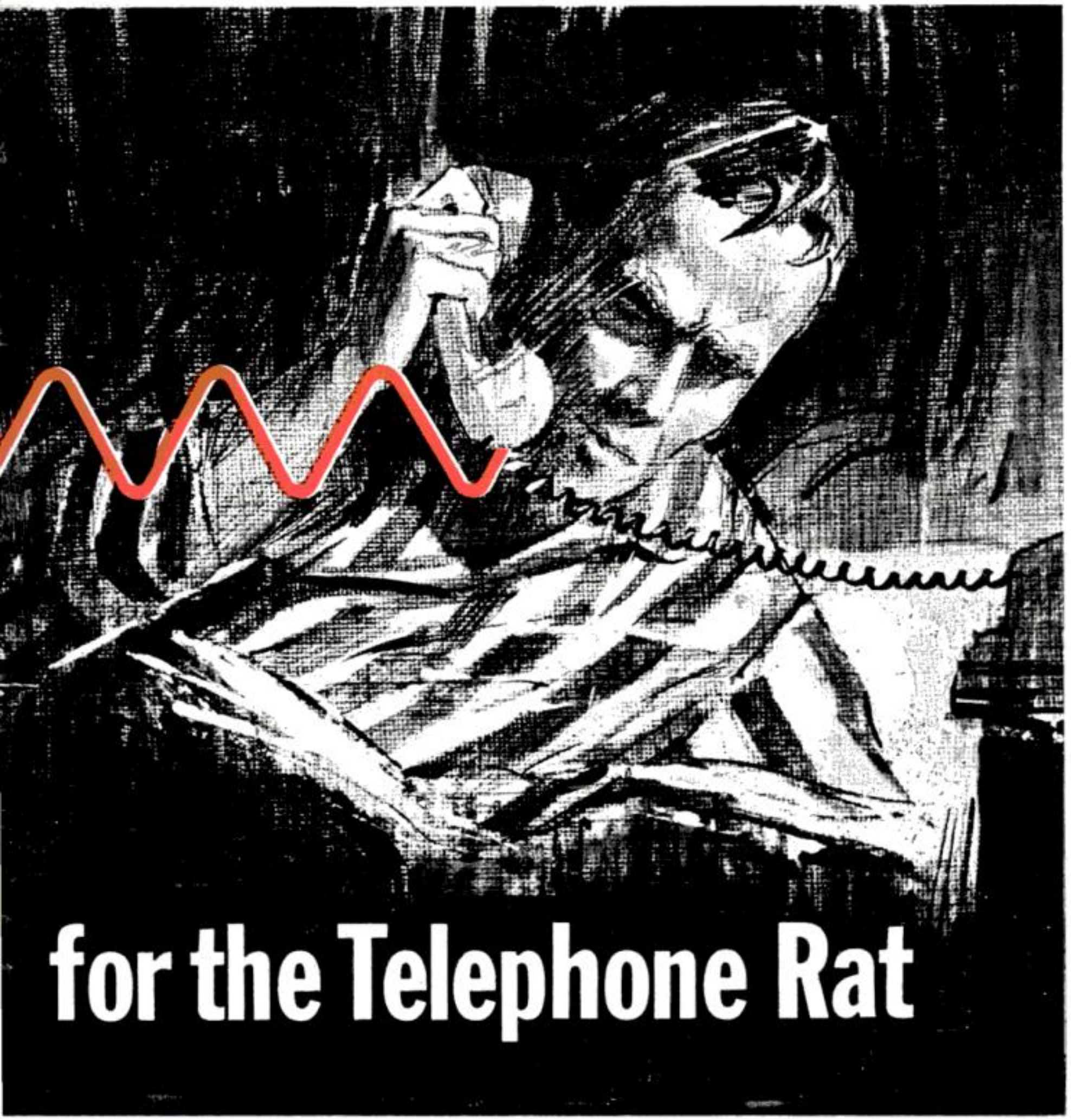
A new technique that can safeguard you against an old pest... the nuisance caller

VOICEPRINTS: Poison



Electronic pictures—voiceprints—can identify people as surely as fingerprints. The sample at left is a print of reporter James Berry's voice saying "POPULAR SCIENCE magazine." Even the most skillful mimic could not duplicate a contour spectrogram of your voice, nor will your voiceprint pattern change as you—and your voice—grow older.

Urheberrechtlich geschütztes Material



for the Telephone Rat

By James R. Berry

NOT long ago, the phone rang in the home of a Connecticut public official. When he'd hung up, what had poured into his ears left him unsettled for hours. The caller had threatened his life, describing in gruesome detail just how the murder would take place. As the anonymous voice droned on, the official had slammed the receiver down on its cradle.

But the annoyance had only begun. The pest renewed his threats, calling late at night or in early morning. Finally, the harassed official decided that his tormentor was more than a fly-by-night crank and asked the police to find him.

The official was only one of thousands who are plagued by nuisance callers. Threats, obscenities, slanders, and the harassment of women with intimate questions are the stock in trade of the telephone pest. The oral pervert chooses his victims because he may have been offended by a remark someone made at

CONTINUED 81

Urheberrechtlich geschütztes Material

So distinctive is your voice that even disguising it can't

a community meeting, or he may just pick a name out of the telephone book.

Law-enforcement agencies have been almost helpless to deal with cases of this sort, until recently. Now, using the sound spectrograph, a new machine that converts speech and other sounds into pictures called spectrograms and as identifiable as fingerprints, police have a weapon that could wipe out this menace to you and your family.

How it is used. To end the official's harassment, and with court permission, the man's line was tapped and the caller's voice recorded on tape. Detectives then picked up a suspect who held a grudge against the public figure, taped his voice, and sent the two samples to the Bell Telephone Laboratories in Murray Hill, N.J.

There acoustics expert Lawrence Kersta made a sound picture of the threatening conversation. Then he made a picture of the suspect's voice. They weren't the same, Kersta said, and the suspect was released.

But Kersta went back over the taped threatening calls and discovered that *two* men had been making calls. Additional suspects were rounded up and more voice samples made. This time guilty voiceprints matched the taped threats. The District Attorney used the evidence to get indictments and the anonymous calls stopped.

But identifying voices is simply one of many assignments the sound spectrograph is capable of performing. Among others it is helping:

- Oceanographers to learn the language of porpoises and other marine animals.
- Psychiatrists to gauge the emotional state of mental patients.
- Psychologists to determine what characteristics of a voice make it recognizable to others.
- Therapists to correct children's speech defects.

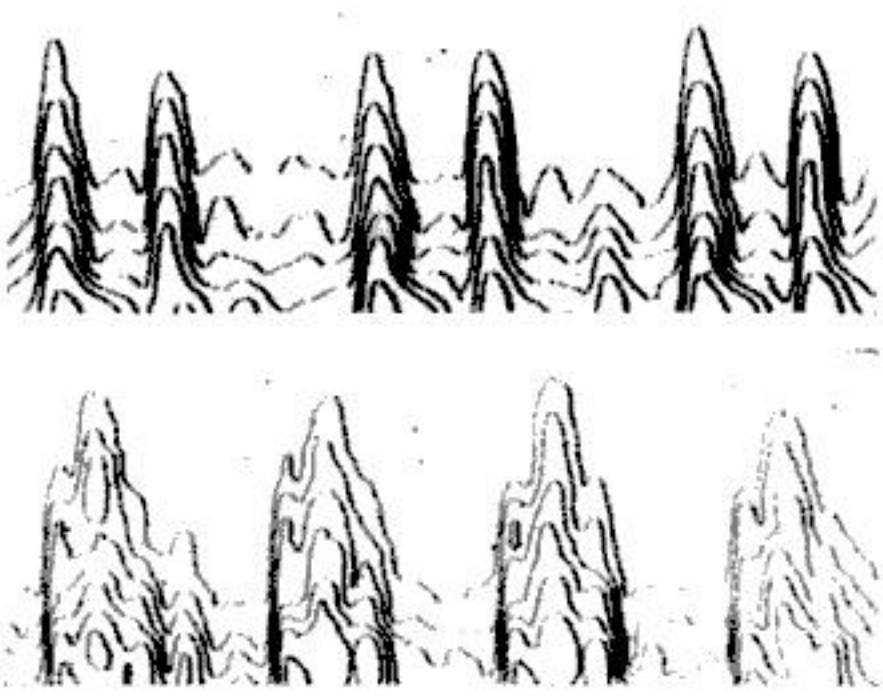
The spectrograph sketches its electronic pictures, or spectrograms, by breaking sound's basic elements—frequency, loudness, and duration—into lines on electrically sensitive paper. These lines reveal vital information that the ear misses or doesn't have time to register.

One of the most promising applications of sound spectrography now being explored is in the field of medicine. Various body noises—respiration, heartbeat, resonance of a thumped chest—are important health signposts. But physicians had no easy way to analyze these noises at leisure or compare changes over long periods. The sound spectrograph hands them this chance.

At New Jersey's Seton Hall College of Medicine, Dr. Mortimer Schwartz is now collecting spectrograms of normal and diseased hearts. Certain heart sounds indicate specific cardiac ailments. Using heart spectrograms—called heartprints—Dr. Schwartz has been able to spot accurately some heart disorders before more obvious signs appeared.

To see what the spectrograph looks like and find out how it operates, I visited the Bell laboratory. There, in a small room cluttered with electronic gear, I talked with Tony Prestigiacomo, one of Bell's electronics experts.

"The first step in making a spectrogram is taping the signal you want to



Heartprints made by the spectrograph promise to become an important diagnostic aid. Print at top, above, is sound of normal heart, lower one indicates a heart murmur. Spectrograms of other body sounds can also be made.

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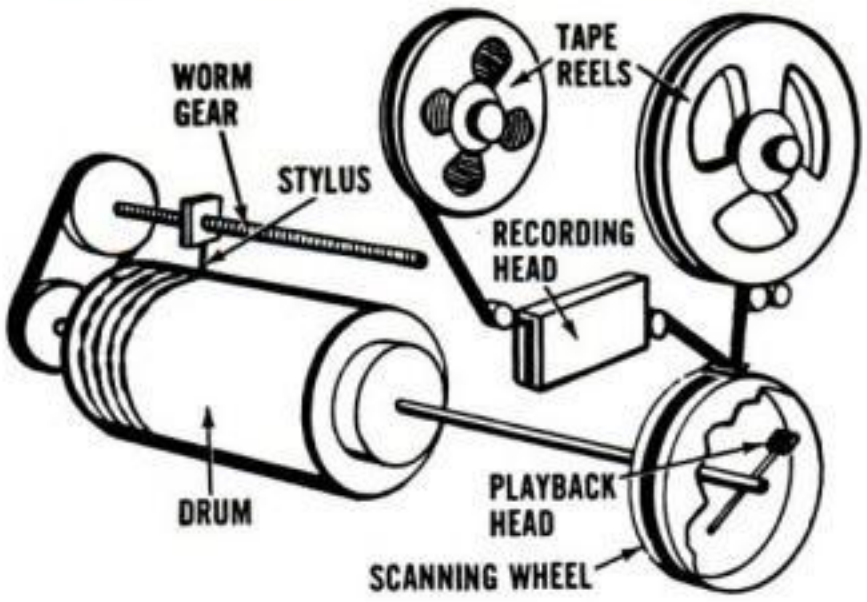
fool this new machine



How spectrogram is made: Portion of a tape with recorded voice is isolated from reels and wrapped around a scanning wheel. Playback head inside wheel scans signals as wheel turns in time with paper-faced drum. Stylus creeping across drum burns in signals on paper.

Recording the pattern of his own voice. Tony Prestigiacomo, Bell electronics expert, demonstrates machine he helped develop. He'll have a voiceprint for analysis in minutes.

analyze," he explained. "Then a playback head scans a section of the tape 400 times, each scan recording a higher group of frequencies than the one before. The spectrograph analyzes a sound for frequencies between 50 and 7,000 cycles per second in steps of 17 cycles per second."

How it works. Prestigiacomo pushed a button to start the tape reels turning, then handed me a mike. "Say something," he suggested.

"POPULAR SCIENCE magazine," I spouted.

Jabbing another pushbutton, Prestigiacomo stopped the reels, and fastened around the wheel the section of tape holding my words. The length of tape he could fit on the wheel carried just 2½ seconds of speech, the most the spectrograph can analyze at a clip. Next, he hit another pushbutton and a playback head inside the wheel began to turn, its tip almost grazing the inside circumference and picking up the signal from the stationary tape wrapped around the outside.

Then Prestigiacomo wrapped a sheet of electrically sensitive facsimile paper around the drum. A steel stylus, powered by a long worm gear, started to creep across the paper, burning in the signals relayed by the recording head.

A little more than a minute later the machine stopped and I was handed my voiceprint. "Can you show me where the syllables are?" I asked. Prestigiacomo marked under the smudgy bars the vowels and consonants they stood for.

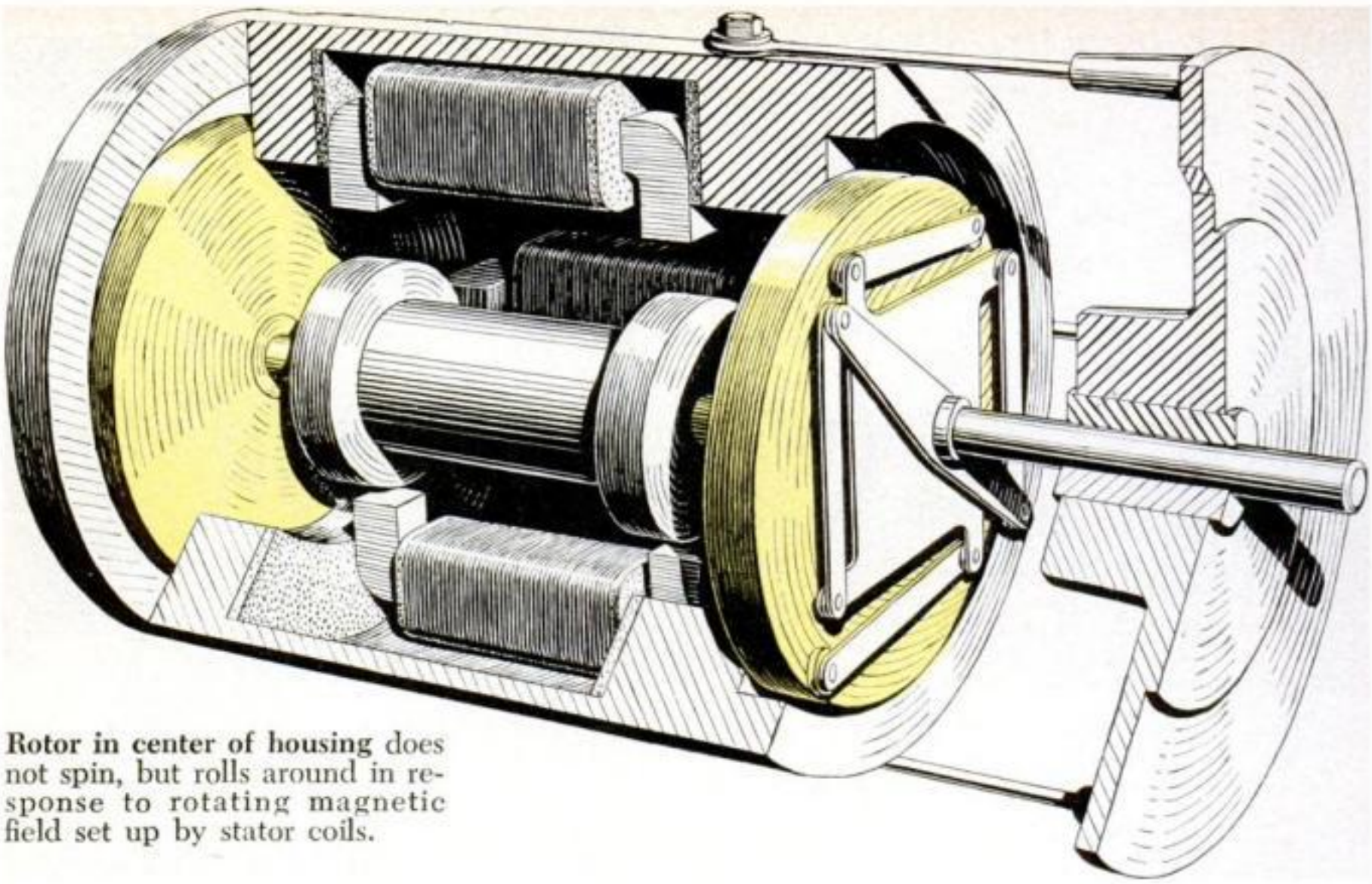
The potentials of the sound spectrograph as a tool in criminal investigation were discovered three years ago when a rash of bomb threats to airlines delayed airport schedules and created panic among passengers. With no way to prove which suspect phoned in the threats, police were hamstrung. They asked Bell labs if the spectrograph could positively identify voices.

Lawrence Kersta, the acoustics specialist, had the answer: a definite yes.

"The shape of the mouth, throat, and nasal cavities all cause sound energy to concentrate in a certain basic pattern," he explains. "This, plus vocal mannerisms learned in childhood, make individual speech as unique as fingerprints."

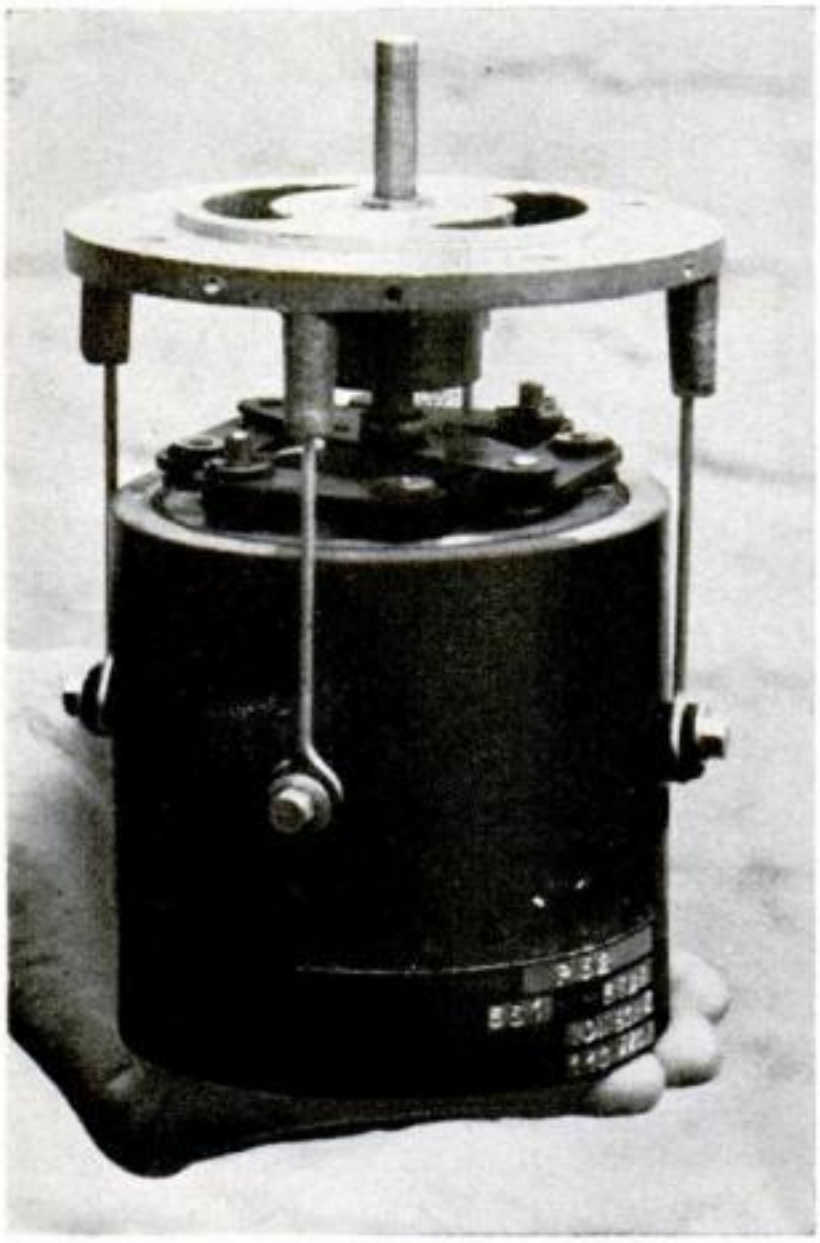
So unique that you can't disguise your voice, nor can the finest mimic reproduce it, to fool the machine. ■■

Urheberrechtlich geschütztes Material



Rotor in center of housing does not spin, but rolls around in response to rotating magnetic field set up by stator coils.

Unique Rolling-Rotor Motor



All-purpose, virtually indestructible motor comes in speeds from two to 200 r.p.m.

By David Scott

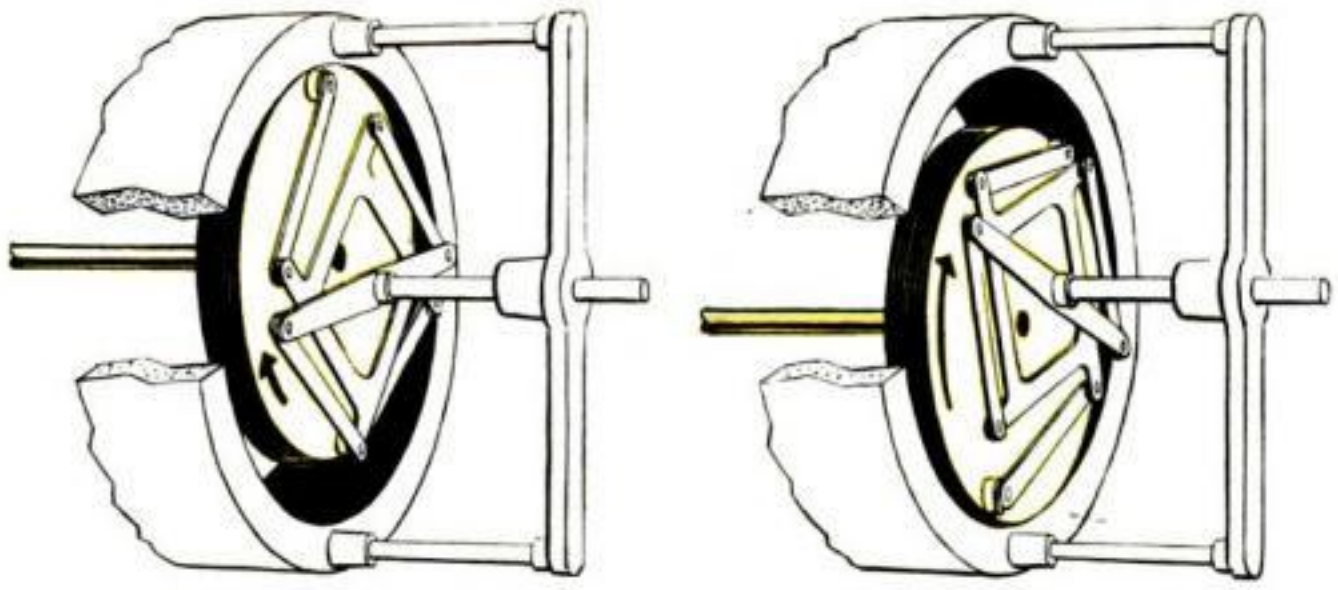
HERE's a radically new electric motor with no bearings, brushes, or other wearing parts. It needs no lubrication or maintenance, and can't burn out from stalling or mechanical overload. A slow-motion runner, the Steromotor, as it is called, has fixed speeds from two to 200 r.p.m. with high torque. It reaches full power in a hundredth of a second, and can be reversed under load as fast.

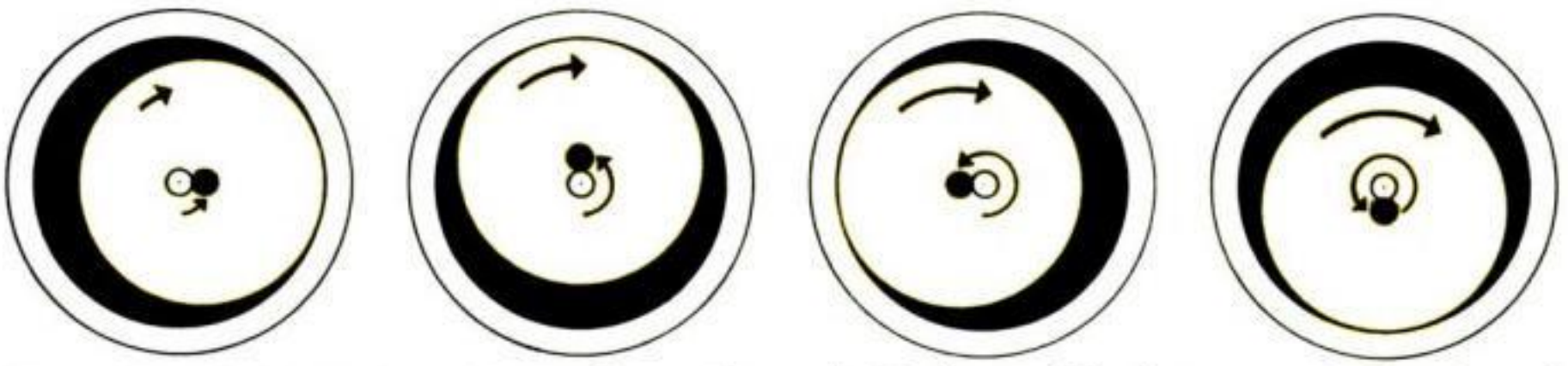
Without any reduction gears, it could open garage doors, turn a barbecue spit, aim a TV antenna, power a small hoist, or drive a lathe. In a washing machine it would eliminate motor burnout when a jam stalls the machine. Industrial applications range from conveyors and railroad signals to nuclear-reactor handling devices.

The new twist in the Steromotor, which originated in France and is being developed and produced in Britain by Evershed & Vignoles Ltd., is that the rotor doesn't turn on its axis: It *rolls* freely

Urheberrechtlich geschütztes Material

Flexible linkage couples orbiting rotor to output shaft running in nylon bushing on mounting flange. The eight-jointed linkage permits the hard rubber tire to roll around the track provided for it, while converting its epicyclic motion to circular motion. Motor produces audible hum, but vibration is isolated by the spring suspension.





How tire rolls in track is shown above. The smaller the tire, the greater the r.p.m. A gap of 2½ thousandths between wheel and track gives two r.p.m.; 37 thousandths, 200 r.p.m.

Can't Burn Out

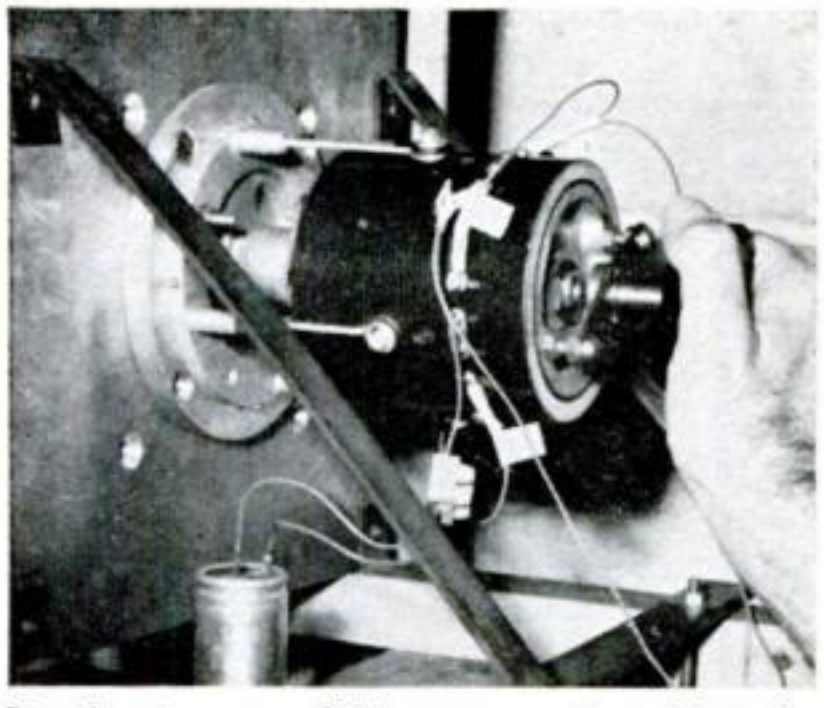
around the stator bore. Rubber-tired wheels on the ends of the shaft circle inside hair-breadth-larger annular tracks in the casing. They carry the rotor through an epicycloidal path (a circle revolving around a circle), and act like an epicyclic gear train to reduce output speed by as much as 1,500:1.

How it works. As in a normal synchronous motor, the stator field coils produce a rotating magnetic field. The rotor, however, is unusual, consisting of a cylindrical permanent magnet with round lamination packs on its top and bottom pole ends. It's supported by aluminum wheels on a central shaft which locate it axially but permit limited radial movement because of oversize tracks.

The gimmick is that the rotating magnetic field actually pulls the rotor outward toward it, aligning the permanent-magnet core with the instantaneous magnetic flux. As the flux moves, the rotor rolls around in step. There is no tendency for it to ro-

[*Continued on page 190*]

Tiny gap between bottom tire and annular track of two-r.p.m. motor is barely visible.



Starting torque of 10-r.p.m. unit is 30 inch-pounds, cannot be restrained by hand.

Urheberrechtlich geschütztes Material

Electronic Lifeline on the High Seas

The Lakonia was sinking, her decks ablaze. Mercifully, help came—dispatched by a computer thousands of miles away

By Theodore Irwin

THE seas were running high in 20-knot winds as the luxury liner Lakonia, packed with 650 British tourists, headed for sunny Madeira and the Canary Islands. It was Dec. 22, 1963, and in the main saloon, dancing and other festivities marked the approach of the Christmas holidays.

Then, without warning, came a hint of impending disaster. A steward spotted smoke seeping under the door of the barber shop. He flung it open and fell back before a wall of flame. It was 11:00 p.m.

"Hell of a time for a fire drill," one of the dancers grumbled as the alarm bell sounded.

The fire raced through passageways toward the staterooms, and in 10 minutes the entire upper deck was ablaze. Capt. M. N. Zarbis ran to the radio room and ordered the operator to tap out the first word of the emergency: "FIRE ON BOARD." The second message was sent just 30 minutes later as the flames continued their relentless advance: "WE ARE LEAVING THE SHIP—NEED ASSISTANCE IMMEDIATELY."

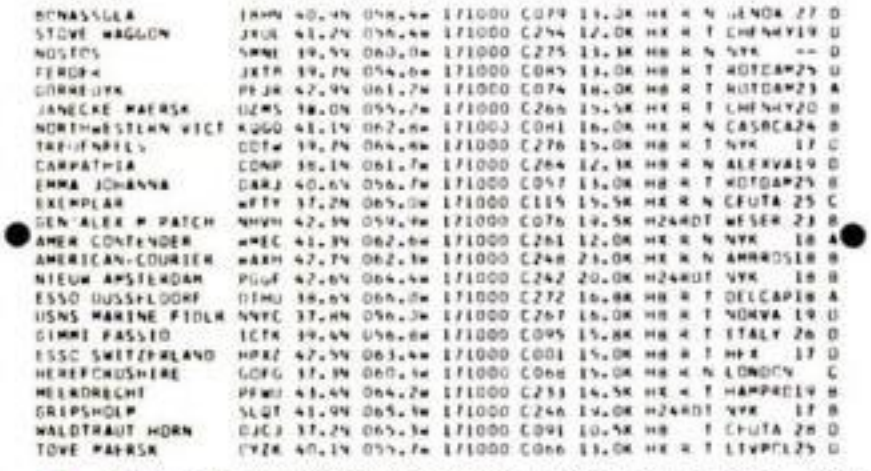
At 12:20 a.m., the radioman sent his final anguished message: "SOS FROM LAKONIA. I CANNOT STAY IN WIRELESS ROOM. WE ARE LEAVING—PLEASE HELP."

After almost two hours of feverish fire-

HOW THE ELECTRONIC LIFELINE WORKS

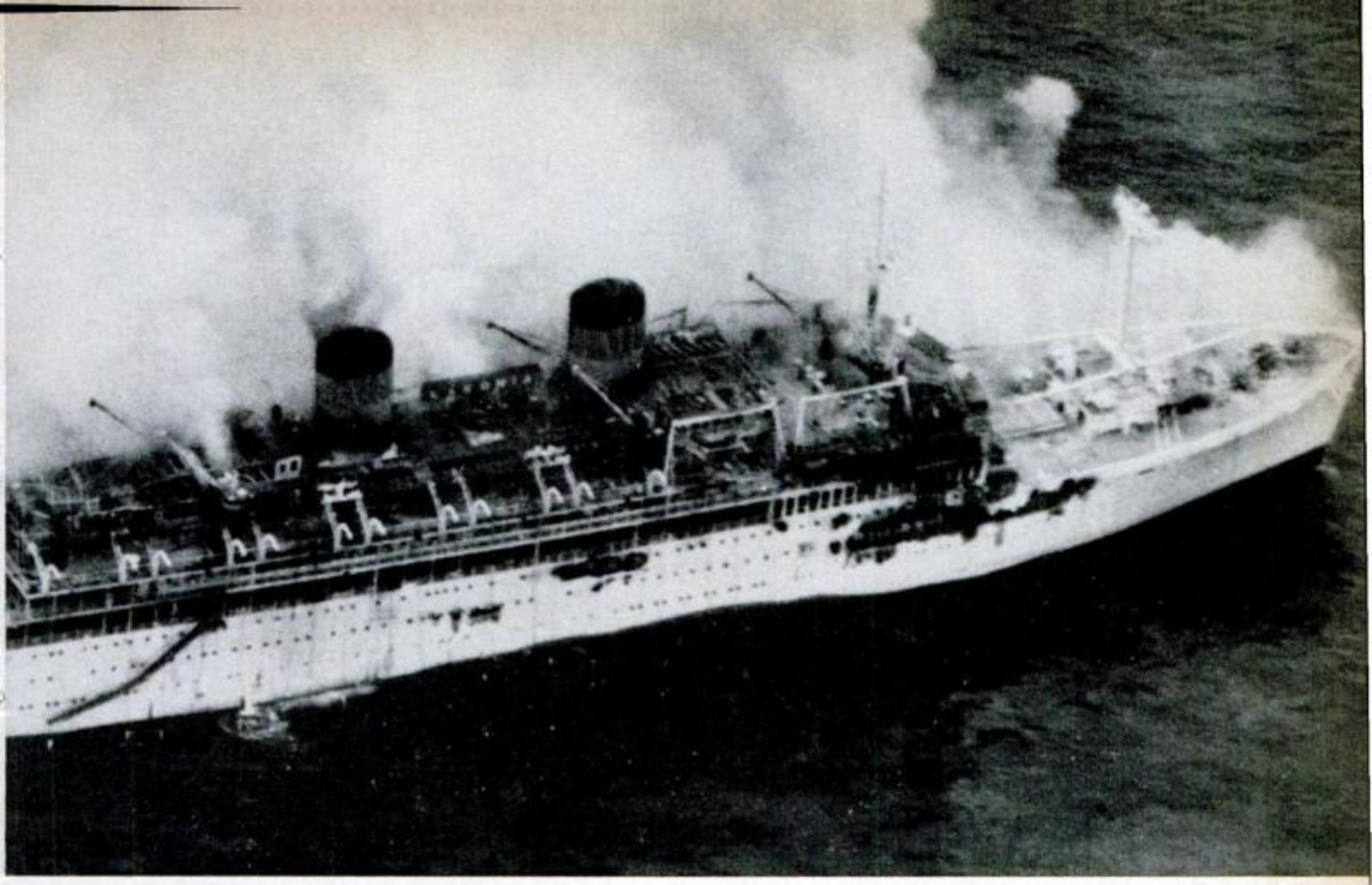
1 Appeals for help from ships all over the globe are relayed to AMVER.

2 Computer in New York gives instant data on closest rescue ships.



3 Sample SURPIC (surface picture) shows ship name, call sign, position, time, course, speed, rescue capability, destination, expected arrival time.

Urheberrechtlich geschütztes Material



fighting, Captain Zarbis gave the order for all hands to abandon ship.

Listing badly, the Lakonia turned into a fiery nightmare. Panicking, the survivors struggled to escape the explosions that could be expected when the fire reached the ship's 500 tons of fuel oil.

AMVER to the rescue. Among those receiving the Lakonia's SOS was U.S. Ocean Station Charlie in the Azores, which relayed it to New York. There, Quartermaster Bob Dinehart and Radarman Charles Stewart were standing a routine watch at the Coast Guard's AMVER (Automated Merchant Vessel Report System) center on the seventh floor of the Custom House. SAR (Search and Rescue) down the hall was asking for a "SURPIC, 100-mile radius, of 35.ON 15.2W."

SURPIC is short for *sur*face *pic*ture, a plot of the vessels within a specified area. A SURPIC can be obtained in just six minutes, thanks to a computer. Dinehart rushed to the machine, waited until it typed out the answers. Five merchant vessels were within a 100-mile radius of the Lakonia, including the Montcalm, a British tanker.

In less than two minutes the SURPIC was teletyped to Ocean Station Charlie in the Azores. Charlie instantly relayed the

CONTINUED

4 Ships listed on SURPIC are contacted, asked to volunteer aid and assistance to troubled ship.

5 Vessels closest – usually within 100-mile radius—change course and head for the rescue area.

6 Mission accomplished. Thanks to AMVER's electronic lifeline, help arrives swiftly on scene.

Urheberrechtlich geschütztes Material

Ruykert Fowler, 9, passenger on the American freighter Wolverine State, owes his life to AMVER. An SOS brought help from the Bremen when young Ruykert came down with an attack of acute appendicitis. The two vessels steamed within sight of each other, waited 10 hours for the sea to calm down. Finally, Bremen seamen made the transfer (left), and the appendectomy was performed. Patient's recovery was swift.

Lakonia's distress alert to the five vessels. The Montcalm arrived first. Flames were shooting out of the Lakonia's portholes and the ship was being shaken by explosions. Survivors struggled in the water, some of the children floating in life jackets like papooses.

The men on the Montcalm took aboard close to 250 passengers and crew, transferring the badly injured to other vessels that arrived later. By dusk of the following night, the rescue ships headed for ports with 896 survivors out of the 1,036 passengers and crew of the ill-fated Lakonia.

What is AMVER? A phenomenally successful maritime mutual-aid program, AMVER answers at least three emergency calls for a SURPIC a day. Under the system, ships of 62 nations voluntarily radio their sailing reports and periodic positions to AMVER. This data goes into a computer that generates and maintains dead reckonings while the ships are within a plotting area. On any given day, the center can track the course and position of about 1,000 ships simultaneously.

Hurricanes whip at a helpless ship, a plane has to ditch, a boiler explodes, a seaman is stabbed by pains of acute appendicitis. The vast oceans can be very lonely at such times. Via the electronic brains at AMVER, medicines and iron lungs are parachuted to ships, doctors arrive in helicopters, ships change course instantly to go to the aid of a vessel in distress.

Started in 1945 as a manual plot of coastal ships, AMVER expanded to the mid-Atlantic and then to the entire North Atlantic. Last December, the first AMVER computer was phased out, and a new IBM 1401 installed. Coverage was first extended to the South Atlantic, then, as of July 1, to the Pacific, too.

Position reports pour in at AMVER's high-ceilinged Custom House headquarters, indicating departure times, destinations, courses, speeds, and ETAs (estimated time of arrival). The data is punched on a computer card along with such details as whether a doctor is aboard, hours of radio watch, radar installation, and search capabilities. The computer stores the data in its electronic memory, ready instantly for SURPIC use.

The $325,000 IBM 1401 also stores characteristics of 16,000 of the world's 18,000 merchant ships in stacks of magnetically treated metal disks; each stack of 10 is capable of retaining two million items of information.

Sending a SURPIC. The vital SURPIC can be obtained for ships within a 100-, 200-, or 300-mile radius of where help is needed. The computer—scanning its records—automatically whirs out the answers onto cards. The data is converted into telegraphic code on tape by a card-to-tape converter, ready for instant transmission.

Thus, if AMVER gets a phone call from SAR that a seaman is critically ill, a SURPIC reveals the names and locations of nearby ships with doctors on board. AMVER determines which ship is in the best position for a fast rendezvous, and passes the facts on to the Rescue Center, which asks the ship to volunteer medical aid.

Crisis is the routine. In recent months, AMVER has played a key part many times. It helped avert an epidemic last April when the Margarita's master, first officer, and eight crew members were stricken with

[*Continued on page 196*]

Urheberrechtlich geschütztes Material

Fire Truck That Swims

Army Commando, on which truck is based, climbs two-foot wall, takes 70-percent grade.

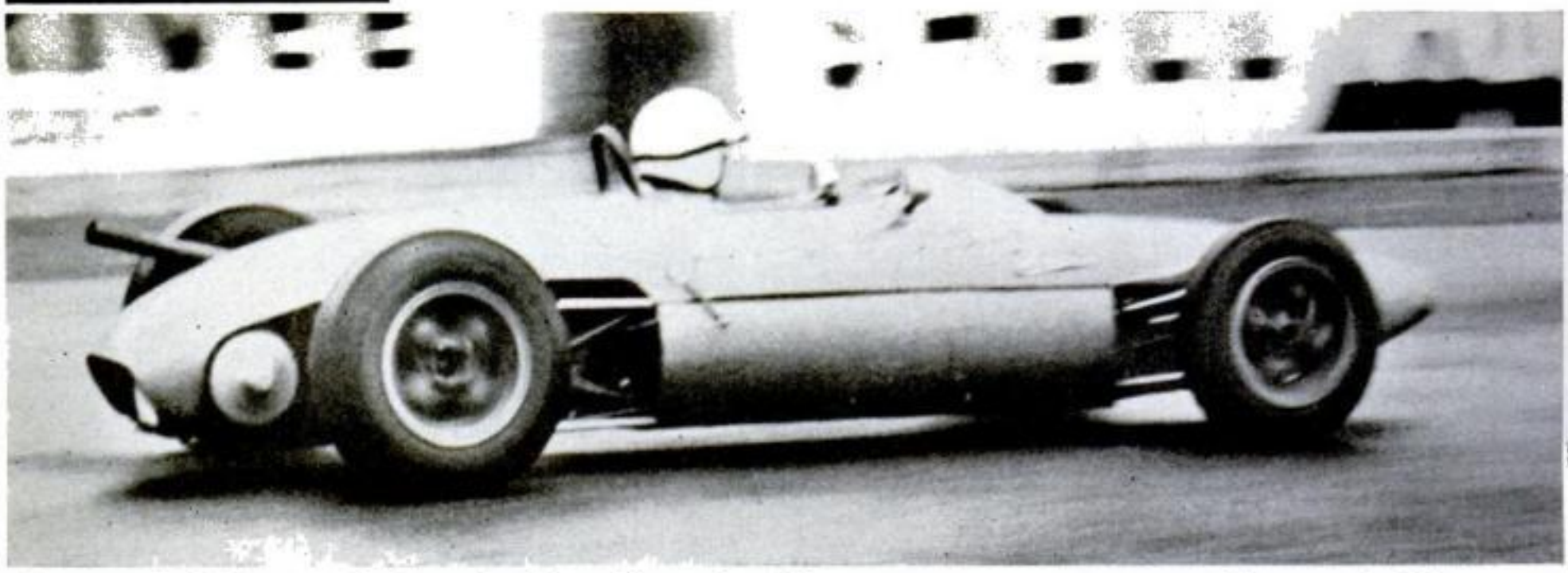
High ground clearance and rugged construction enable this fire truck to clear off-road obstacles, crash through brush, travel on sand, mud, snow, or across water. Built on a military-vehicle chassis, it has two reel-mounted hoses. The nozzle rotates for a 360-degree fire-fighting sweep.

Amphibious car swims streams at four m.p.h., climbs sandy beaches, mud banks.

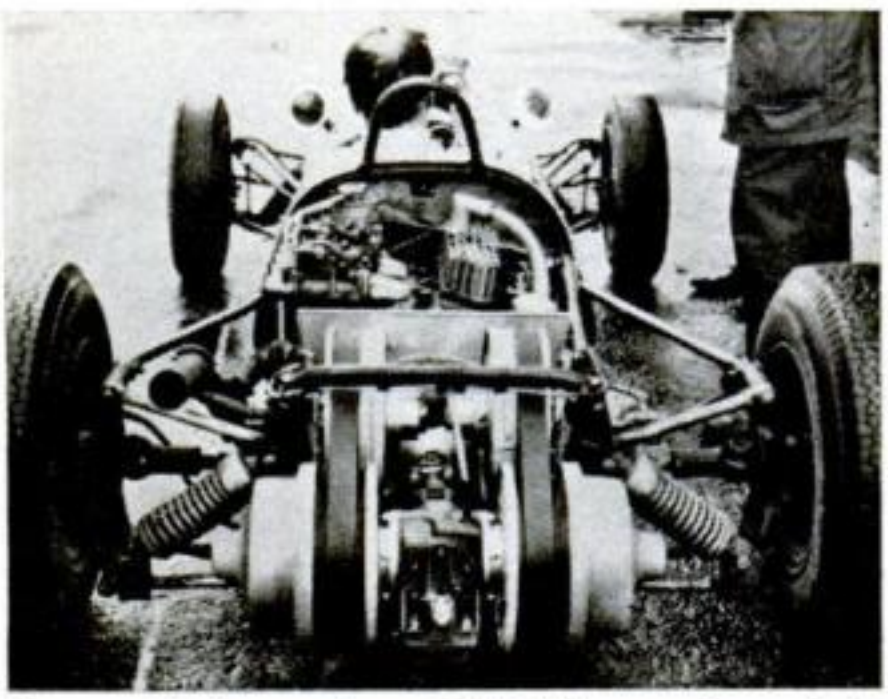
NO FIRE is inaccessible to this new fire truck. Equipped with fire-fighting implements instead of a gun turret and other military armament, the Commando Fire Fighter is based on the Commando V-100, an off-road amphibious Army vehicle. Like the military version, it needs no road to get where it's going, can make its way through rough or muddy terrain, can even swim a stream or lake to get to a fire. Its watertight hull is powered by a waterproof Chrysler 210-hp. engine. The vehicle carries 1,000 feet of 2½-inch fire hose, a revolving high-pressure, ground-sweeping nozzle for either water spray or a foam blanket, a high-efficiency pump, and hydraulic winches with a 10,000-pound pull.

Cadillac Gage Co., Detroit, plans to have a production model ready this fall along with a tear-gas-launching armored car for police riot-control duty. It has gun ports. A "shocker" keeps rioters away.

Urheberrechtlich geschütztes Material



Absence of shifting in Variomatic drive allows the driver to concentrate more on the race itself.

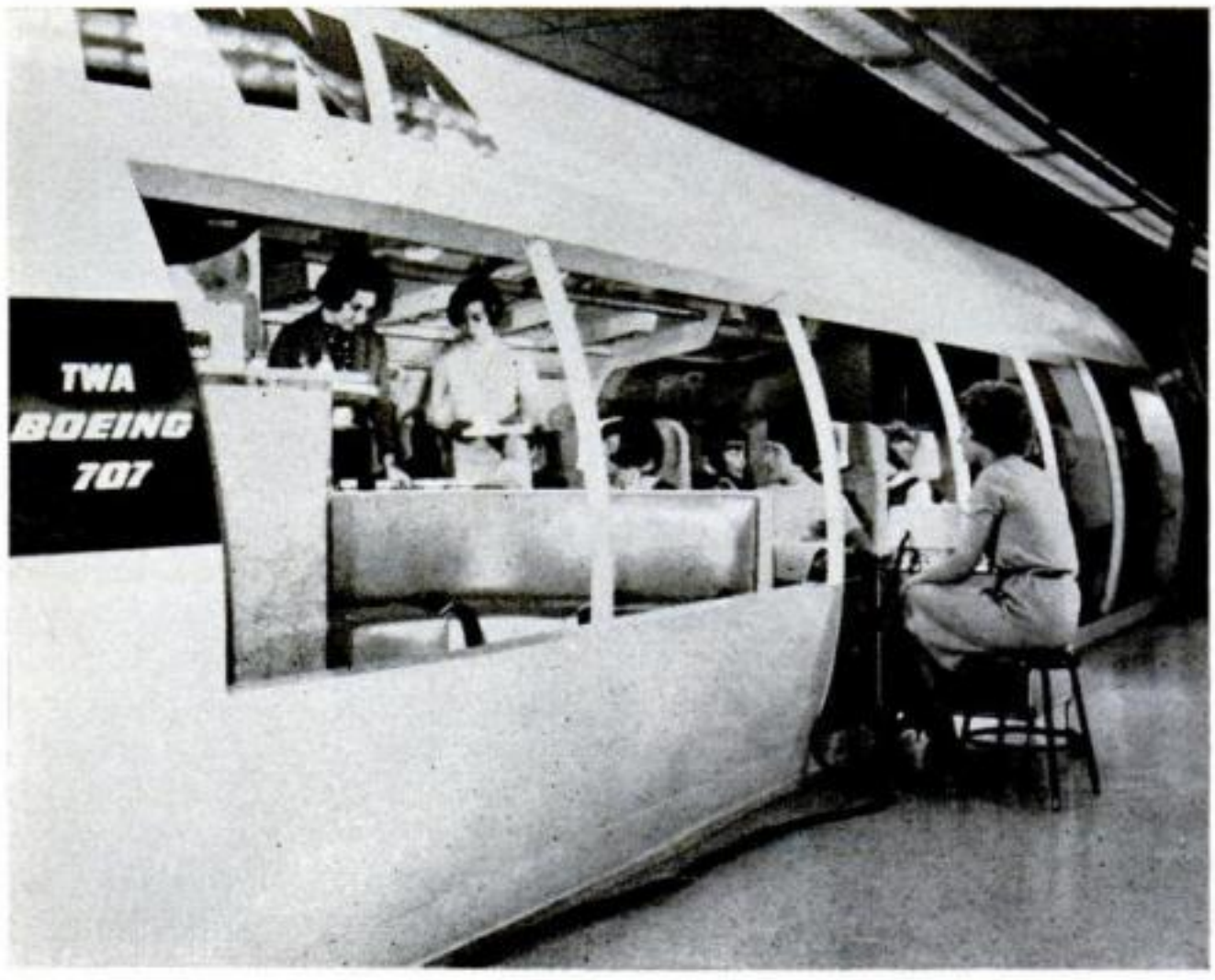


Rear end of experimental DAF racer shows belt drive. Wheels are driven by the front pulleys.

Automatic shift on belt-drive racer

Dutch DAF uses a belt-drive automatic transmission instead of a gearbox on its experimental racing car. It has upgraded the Variomatic of its little 30-hp. Daffodil sedan to suit its variable-diameter pulley to larger cars. The racer has a one-liter Ford engine beefed up to 100 hp. Output goes through a centrifugal clutch to bevel gearing to drive the two rear pulleys. The effective diameters of the pulleys are continually variable between low and overdrive. The rear wheels are geared directly to individual forward pulleys.

Initial trials showed improved acceleration over a manual gearbox. Absence of shifting gave a smooth power flow.



Stewardesses train in mockup jetliner

In TWA's training school for stewardesses at Kansas City, Mo., girls start learning their duties in a mockup of a jet airliner similar to one in which they will serve.

Here a couple of the trainees get practice in serving meals to air passengers while still on the ground. Their instructor sits outside the cabin where she can watch all their movements and give directions to bring their techniques to perfection.

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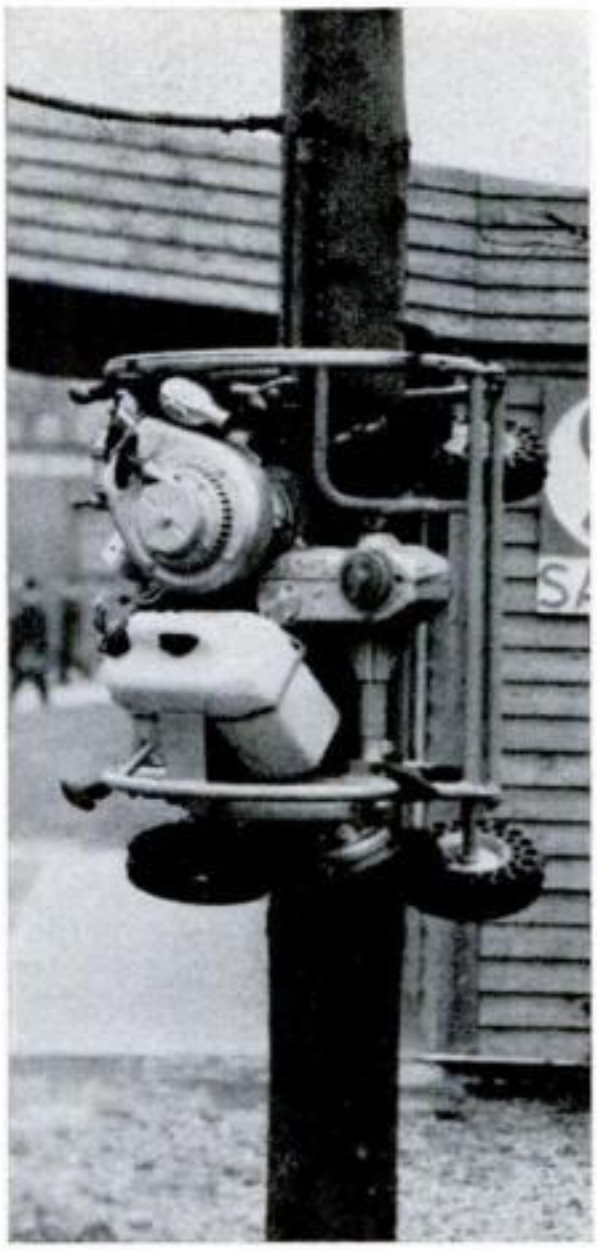


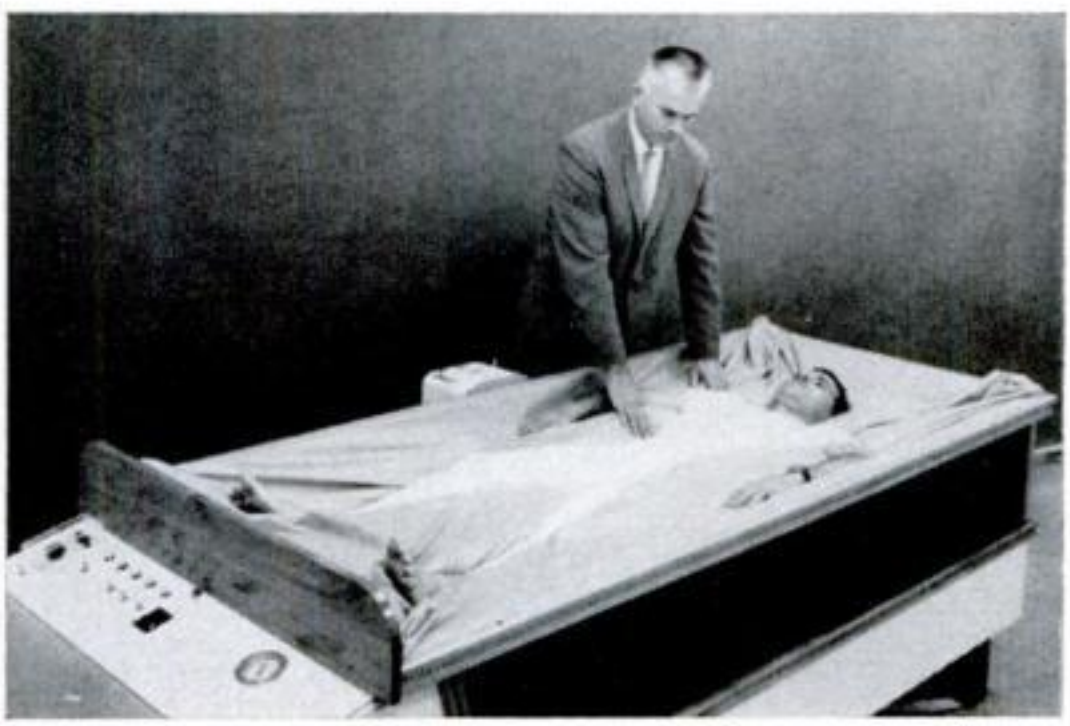
Machine climbs tree, saws off branches

The machine above climbs a tree to any preset height, spiraling the trunk like a monkey. A chain saw mounted on it lops off dead and dying branches close to the trunk as it climbs.

The Swiss Tree Monkey, by pruning forest trees with a minimum of labor, is said to promote knot-free growth. It climbs at 15 to 20 feet a minute, comes down faster.

World's largest trimaran is 64 feet

Built for charter work in the Caribbean, the 64-foot 20-ton Triptych, world's largest, carries 1,400 square feet of sail and two diesels for 15-knot cruising. Cabins in her three hulls sleep 10; a 22-by-12-foot dining saloon and bar seat 15. Matt Burpee, Canadian owner, had the craft built in England at a cost of $70,000.



Hospital patients find rest on flotation bed

A patient on a waterproof sheet floats on a tank of water in the bed at left, developed to simulate weightlessness in space research.

Test patients report no sensation of pressure on the body or of being supported. Controls at the foot maintain water circulation and temperature. Side levers raise and lower an internal platform to help in getting in and out. Convair will offer the bed to hospitals.

Urheberrechtlich geschütztes Material

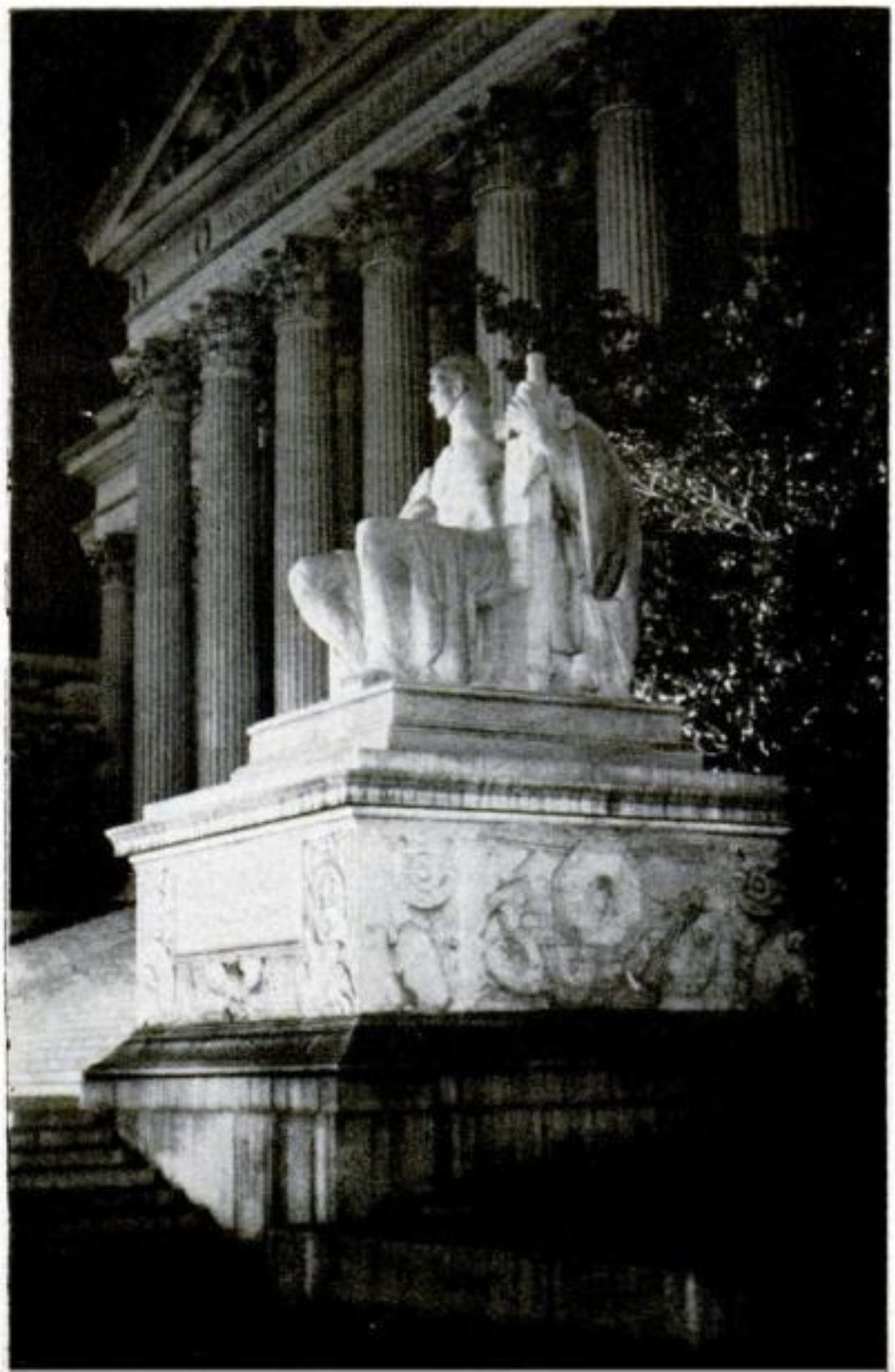
PS PHOTOGRAPHY

The Secrets of Shooting Color at Night

A camera, a tripod, and a little know-how add up to dramatic night pictures. Here's the know-how

By Henry T. Gurley

City skyline is a perfect subject for



Auto light patterns are easy: Just leave the shutter open while they fill themselves in. An extra here is the Capitol in the background.

Monuments and buildings at night are dramatic subjects. To increase the depth of field, close down lens, give long exposure.

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night photography. For best pictures, shoot in early evening while office lights are still on.

WHY put your camera to sleep when the sun goes down? Take it with you for a night on the town. Color pictures at night capture a kind of drama that you can't see by day: golden sunsets, city lights, circuses and carnivals, buildings and monuments made magical by the wash of floodlights, night scapes, night sports—the list is as full as your activities after dark.

No need for fancy equipment, either. If your camera has an adjustable lens opening and adjustable shutter speeds, with provision for bulb or time exposure, you're all set. And, of course, you'll need a tripod and a cable release for shutter speeds longer than 1/30 of a second.

Any color film will do. Daylight film will produce bright warm colors on the reddish side that you may like better than the somewhat colder indoor films designed for tungsten light. The PS Night Exposure Guide farther on lists only daylight films, but there's no reason

CONTINUED

Downtown on Saturday night you'll catch hustle and bustle of the big city. Shooting from building permits larger view. For a still more unusual view, try this scene on a rainy night.

Store windows are fine subjects. A good time to shoot is at dusk, when outside and inside lights balance. There's no glass reflection.

Fireworks etch colorful abstract patterns on film. The secret: Hold the lens open for two or three bursts (see guide for aperture).

Double exposure produces arty pictures that will amaze your friends. It's simple to take: Shoot twice on the same piece of film.

not to use it for tungsten films, too. Just match your tungsten film to the right film-speed grouping.

Is it better to use a fast film than a slow film? In most cases, film speed will not matter. For slow exposures on a tripod, there is little advantage to a fast film—the difference might lie between shooting at ¼ second instead of a second, a matter, normally, of little importance. But a faster film does have an advantage if it will make enough difference in shutter speed so you can shoot with the camera handheld instead of on a tripod—night sports under floodlights, for example.

The settings. The chart on the facing page is a general guide to setting your camera for various night situations. The settings given can only approximate the exact exposure for the conditions of a specific scene. But they will give you a picture. To make sure that you come home with the best picture possible, you should bracket: Shoot a second picture with *four* times the exposure, a third with ¼ the exposure. That means, remember, two stops in both directions. If your setting was *f*/5.6, two stops more exposure will bring you to *f*/2.8; two stops less exposure will be *f*/11. (The standard stops are *f*/1.4, *f*/2, *f*/2.8, *f*/4, *f*/5.6, *f*/8, *f*/11, *f*/16, etc.)

Remember, too, that you can change settings without changing exposure value. A setting of *f*/2 at ⅛ second has the same exposure value as *f*/2.8 at ¼ second, or *f*/4 at ½ second. This is particularly important where the guide shows a lens opening of *f*/2, and your lens has a top speed of perhaps *f*/2.8 or *f*/4.

What should you shoot? City streets are a good place to start taking night pictures, and the best time is on a rainy night. The wet pavement reflects the light and glitter of signs and store fronts, and adds excitement and color saturation to otherwise run-of-the-mill shots. A word of caution: Rain droplets on a lens can cause light flares and streamers, so shoot from under cover.

For an overall view of a city, it's a good idea to shoot from the top of a building or from a nearby hill. The best

Urheberrechtlich geschütztes Material

PS EXPOSURE GUIDE FOR NIGHT SHOOTING

Exposures are approximate. You can change the time or aperture given, as long as the exposure value remains the same. Take additional, bracketing, shots (see text) for insurance.

	THE SCENE	SLOW (Kodachrome II, Sears, Technicolor)	MEDIUM (Agfachrome CT 18, Anscochrome 50, Ektachrome, Peruchrome)	FAST (Anscochrome 100, Ektachrome-X, Ektacolor Type S, Kodachrome-X, Kodacolor-X)	VERY FAST (Anscochrome 200, High Speed Ektachrome)
MOTION	Auto light patterns**	f/4	f/5.6	f/8	f/11
	Floodlit night sports	1/15 @ f/2	1/30 @ f/2	1/60 @ f/2	1/60 @ f/2.8
	Street scenes, very bright	1/8 @ f/2	1/15 @ f/2	1/30 @ f/2	1/60 @ f/2
	Street scenes, bright	1 @ f/2	1/2 @ f/2	1/4 @ f/2	1/8 @ f/2
	Circuses, ice shows	1/30 @ f/2	1/60 @ f/2	1/60 @ f/2.8	1/60 @ f/4
	Fireworks***	f/4	f/5.6	f/8	f/11
SCENIC	Late sunset	1/30 @ f/2	1/60 @ f/2	1/60 @ f/2.8	1/60 @ f/4
	Skyline, just after sunset	1 @ f/4	1/2 @ f/4	1/4 @ f/4	1/8 @ f/4
	City skyline, dark	16 @ f/2	8 @ f/2	4 @ f/2	2 @ f/2
	Home interiors	1 @ f/2.8	1 @ f/4	1 @ f/5.6	1 @ f/8
	Floodlit buildings	4 @ f/2	2 @ f/2	1 @ f/2	1 @ f/2.8
	Store windows (bright)	1/15 @ f/2	1/30 @ f/2	1/30 @ f/2.8	1/60 @ f/2.8
	Outdoor Xmas lighting	2 @ f/2	1 @ f/2	1 @ f/2.8	1 @ f/4
	Medium-lit night clubs	2 @ f/2	1 @ f/2	1/2 @ f/2	1/4 @ f/2
	Landscape, full moon	60 @ f/2	30 @ f/2	15 @ f/2	8 @ f/2

*All films are daylight type. **Use aperture shown; leave shutter open while 10-15 cars pass. ***Use aperture shown; leave shutter open for 2 or 3 bursts.

time is about 20 minutes after sunset in the wintertime. Why winter? Because the sun sets early enough so that office lights will still be on—and you'll have better realism and definition in your picture.

Pattern shots. Carnivals and fairs offer a marvelous chance for unusual patterns of light and color. Try shooting the rides at slow shutter speeds for a feeling of motion and excitement, as well as pattern. Try the Ferris wheel at ¼ and ½ second, the merry-go-round at ½ second. Take pictures of the people, too. You'll find, probably, that the settings on the guide for "street scenes, very bright" are about right for this.

Automobile light patterns offer another chance for unusual photos: flashing streaks of light superimposed on an otherwise normal scene. Taking the pictures is easy. Find a spot above a street or highway (to keep the headlights from striking your lens directly and causing flares). A busy roadway is best—one with four or more lanes so there will be a crisscrossing of lights as cars pass each other and move from lane to lane. Hold the shutter open while 10 or 15 cars pass.

Landscapes under a bright three-quarter moon make magnificently dreamy pictures, and your friends, who will marvel at them, need not know how easy they are to take. Long exposures, plus a steady support, are the secret. One tip: Don't try to include the moon itself in the photo. It will move considerably during a long exposure and leave a white streak.

And don't forget many other wonderful possibilities: candle-light portraits (one second at *f*/4 with Kodachrome-X); scenes round the fire on camping or hunting trips (two seconds at *f*/4 with Kodachrome-X); theater lobbies and airport terminals (⅛ second at *f*/2 with Kodachrome-X); your own home under romantic moonlight, where no one can see the crabgrass or note that your house needs a paint job. ■■

NIGHT SHOOTING IN A NUTSHELL
4 Steps to a Perfect Picture

1. Focus carefully—at the typical large apertures needed for night shooting, you have little depth of field.
2. Use a tripod or other firm support, plus a cable release, for speeds slower than 1/30 second.
3. Set your aperture and shutter speed, using the PS Exposure Guide above.
4. Shoot three times—the first shot with the exposure given here, the second with four times the exposure, the third with ¼ the exposure.

Urheberrechtlich geschütztes Material

what's new for your CAR

Seat-belt harness for children

The Voplex C-2000 belt harness protects both the chest area and pelvic region in sudden stops. It fits children from eight months to six years old. Price: $9.95 from Vogt Manufacturing Corp., 100 Fernwood Ave., Rochester, N.Y.

New aerosol-cleaner can with nozzle extension

Carbon, gum, ethyl stain, and varnish collect in every carburetor and automatic choke. Solvents are hard to aim with normal cans, but the plastic nozzle used above aims Cho-Kleen fluid right where it's needed. U.S. Aviex, 1056 Huntly Rd., Niles, Mich.

Inflator-sealer can for emergency tire repair

Flat tires usually seem to happen on rainy nights, far from service stations. BernzOmatic's Dapper Dan will reinflate the tire and seal off the leak in a minute, for 100 miles of driving. The eight-inch can contains Freon gas and a latex puncture sealant. After using this temporary fix, remember to check your tire pressure as soon as possible—at the first service station.

Aluminum foil for auto-body repairs

You can fix rust spots and sheet-metal rips by taping aluminum foil over the damaged area. The pressure-sensitive tape can also be used as a heat deflector, moisture and dust seal, or as decorative striping. It comes in 360-inch rolls of two-inch width from Dutch Brand Division of Johns-Manville. It has many nonautomotive uses, but was developed with the do-it-yourself car owner in mind.

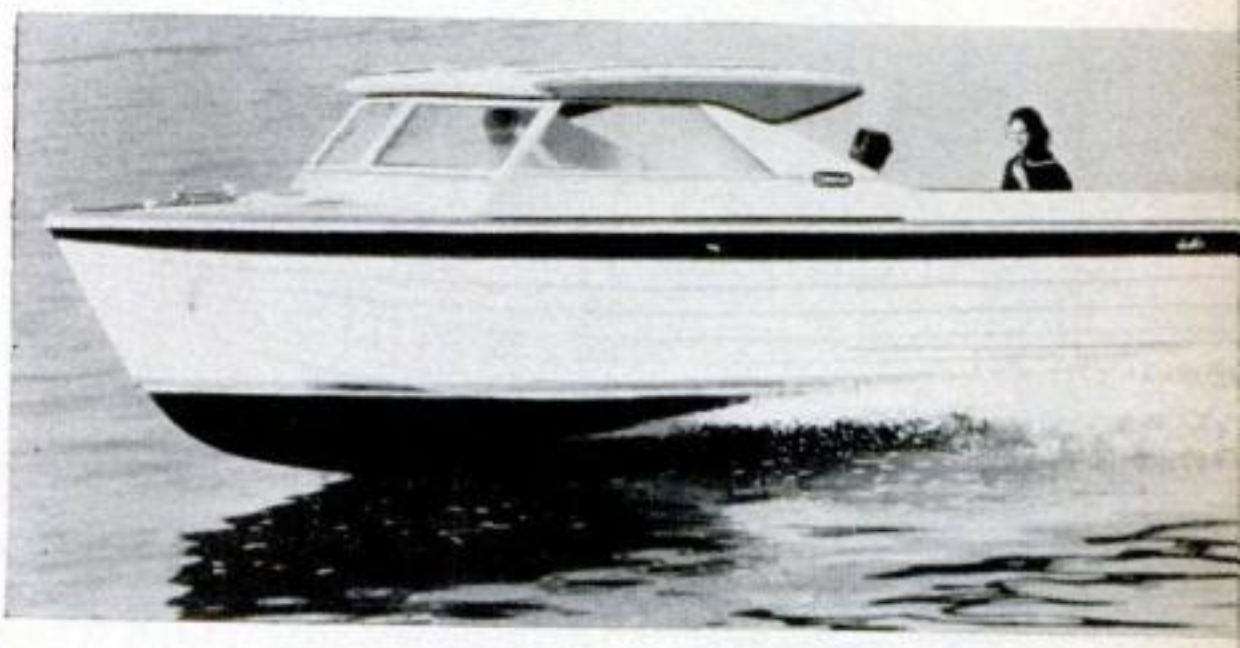
Urheberrechtlich geschütztes Material

what's new in BOATING

Foot-Steerer—a Handy Rig for Fishermen

YOU can steer your boat and still keep both hands on the rod to reel in the big ones, by installing a Troll-Eze on your outboard. The device lets you steer with one foot. It sells for $9.95. Some motors need an adapter kit, at $1.25. Aldor Mfg. Corp., Box 5374, Tulsa, Okla.

Wildcat cruiser howls along on a 185-horsepower V-8 engine



The Wildcat is a 24-foot day cruiser that can also be used as a utility or fishing boat. It has an eight-foot beam, ideal for trailer use; a 150-hp. power-tilt engine is optional. The skiff can sleep up to four and has optional hardtop, ceiling panels, and lounge seats. Owens Div., Brunswick Corp., Baltimore, Md. 21222.

Lightweight loader makes a one-man job of putting a boat on a car

It's easy to get your boat on a car-top carrier with the one-man Boatloader. The lift clamps onto your boat's transom and is easily raised on a pole attached to a trailer hitch. After you raise the boat to the carrier's height, you simply swing it around onto the carrier. It fits all standard trailer hitches. Rust-proof, the device weighs only 11 pounds and can be stored in your car trunk. Cosom Corp., 6030 Wayzata Blvd., Minneapolis.

Urheberrechtlich geschütztes Material

New Ideas from the Inventors

Let-down drawer stows gear. You could carry clothing and camp equipment in better order in this recently patented car-top frame, and have them handy when you made a stop. A weather-sealed drawer would ride flat inside a carrying platform; it would pull out on slides and let down to form an upright rack for clothes hangers and smaller drawers.

Moving slats cut sun's rays. You wouldn't have to avoid the sun to protect yourself from sunburn if you limited exposure with a rig like this. Slowly moving slats, driven by a motor, would alternately expose and shield any given area of your body, thus cutting effective exposure in half. A timer could close the slats completely.

Foot brush cleans boat. With this stiff brush strapped to your foot, you could clean the bottom of your boat more effectively than with a long-handled brush and with less effort than handbrushing under water. The brush would be adjustable on its strap-on mount to accommodate to different hull shapes and working angles.

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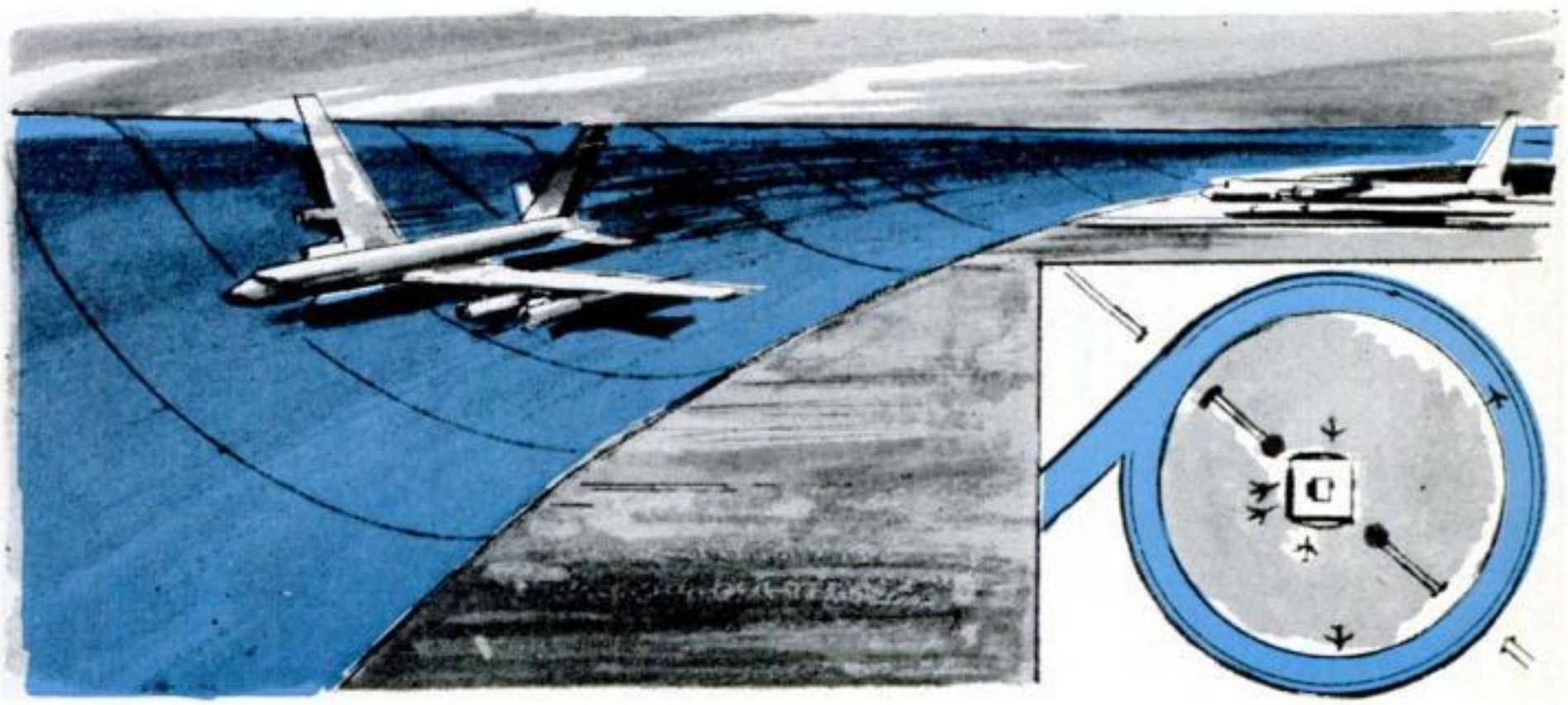
Collapsible bucket protects paint. Left-over paint might stay fresher if it were kept in this can. The spiral-threaded metal outer shell would be slotted so the lip of a bottom plate could ride in it. Turning a ring under the lip would raise the plate, compress a plastic liner, keep paint at the top where the lid could shut out air.

Signal calls for lights out. You couldn't forget to turn off your car lights if you wired this buzzer attachment to door and light switches. Opening the door while the lights were on would unbalance current in a coil and cause a vibrator to sound a reminder. A shunt would keep the buzzer from sounding when the engine was on.



Banked track extends runway. This circular airport might eliminate a plane's "point of no return" at which it doesn't have enough speed for safe lift-off or enough runway to stop and try again. In either case, a pilot would head into the banked rim and make another go-round. Facilities would be at the center of the circular field.

The following patents have been issued on these inventions: **Car-top drawer**—*No. 3,113,819 to N. Bessette, Pawtucket, R.I.;* **Sun stopper**—*No. 3,042,046 to H. Willems, Kenosha, Wis.;* **Foot brush**—*No. 3,085,541 to J. Leach, Port Washington, N.Y.;* **Collapsible bucket**—*No. 3,173,573 to J. Donegan, Middletown, N.Y.;* **Light signal**—*No. 3,172,080 to G. Webb and E. Late, Lancaster, Ohio;* **Circular runway**—*No. 3,173,634 to W. Bary, East Stroudsburg, Pa.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington, D.C. 20231, at 25 cents each. To write to an inventor, if the address above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.

Urheberrechtlich geschütztes Material

Tiny Electric Eye to

By day, it's an automatic doorbell; by night, an alarm. Build your own

By Stuart Hoberman

HERE'S the next best thing to a round-the-clock uniformed doorman: a tiny photocell-relay alarm you can install in any unattended doorway, gateway, or hallway in your home. Anyone passing by its sensitive electric eye instantly triggers a warning bell or buzzer.

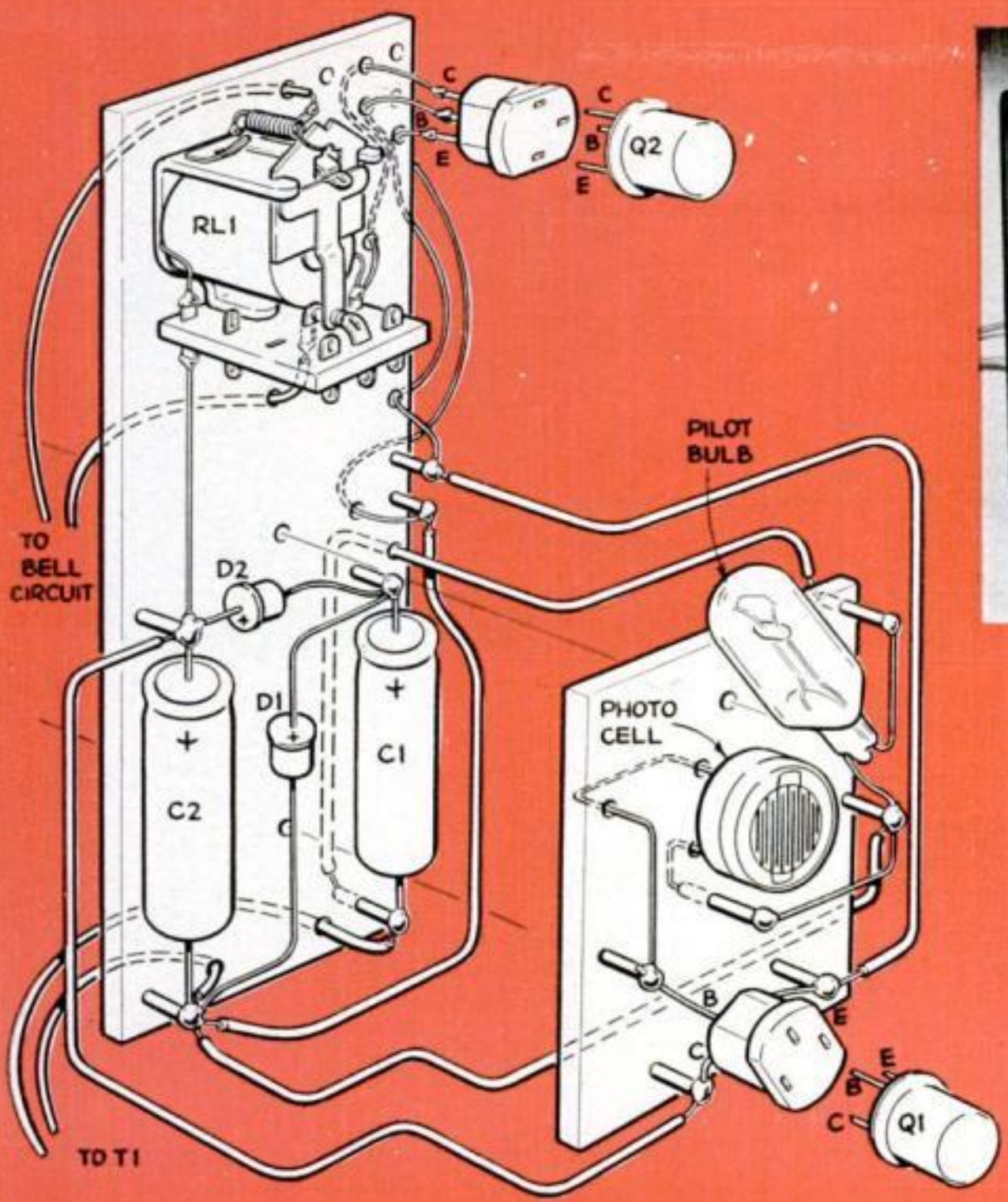
Don't be fooled by its cigarette-pack-size case—this electronic watchdog will guard faithfully any passageway less than four feet wide. You can build it in one or two evenings for under $10.

Heart of the device is a low-cost photoconductive cadmium sulfide (CdS) cell—the same type used in photographic exposure meters. It acts like a light-sensitive resistor: Its electrical resistance decreases as the light intensity goes up, increases as light intensity lowers.

A simple two-transistor (Q1 and Q2) relay circuit monitors the resistance value.

In operation, the unit is mounted on one wall of a passageway, opposite a small mirror on the other wall. A simple optical system concentrates the light from a pilot lamp, projects it toward the mirror.

Urheberrechtlich geschütztes Material



Two lens systems—each a single convex lens in a home-made mount—make the most from pilot bulb's limited light output. Upper lens projects bulb's rays at the external mirror; lower lens focuses the reflected beam on the surface of the CdS cell.

Guard Your Home

The mirror is placed so it reflects the beam back to a second lens, which focuses it on the CdS cell. Because its surface is illuminated, the cell's resistance is low.

A person walking through the passageway interrupts the light beam, causing the CdS cell's resistance to increase suddenly. The monitor circuit detects the change and closes relay RL1, sounding the warning signal.

How to make it. Build the photo relay into a miniature "meter case." Its circuit is wired on two small pieces of perforated phenolic chassis board (Vectorboard) separated with fiber spacers. Use flea clips as soldering points. Mount transistors Q1 and Q2 in sockets.

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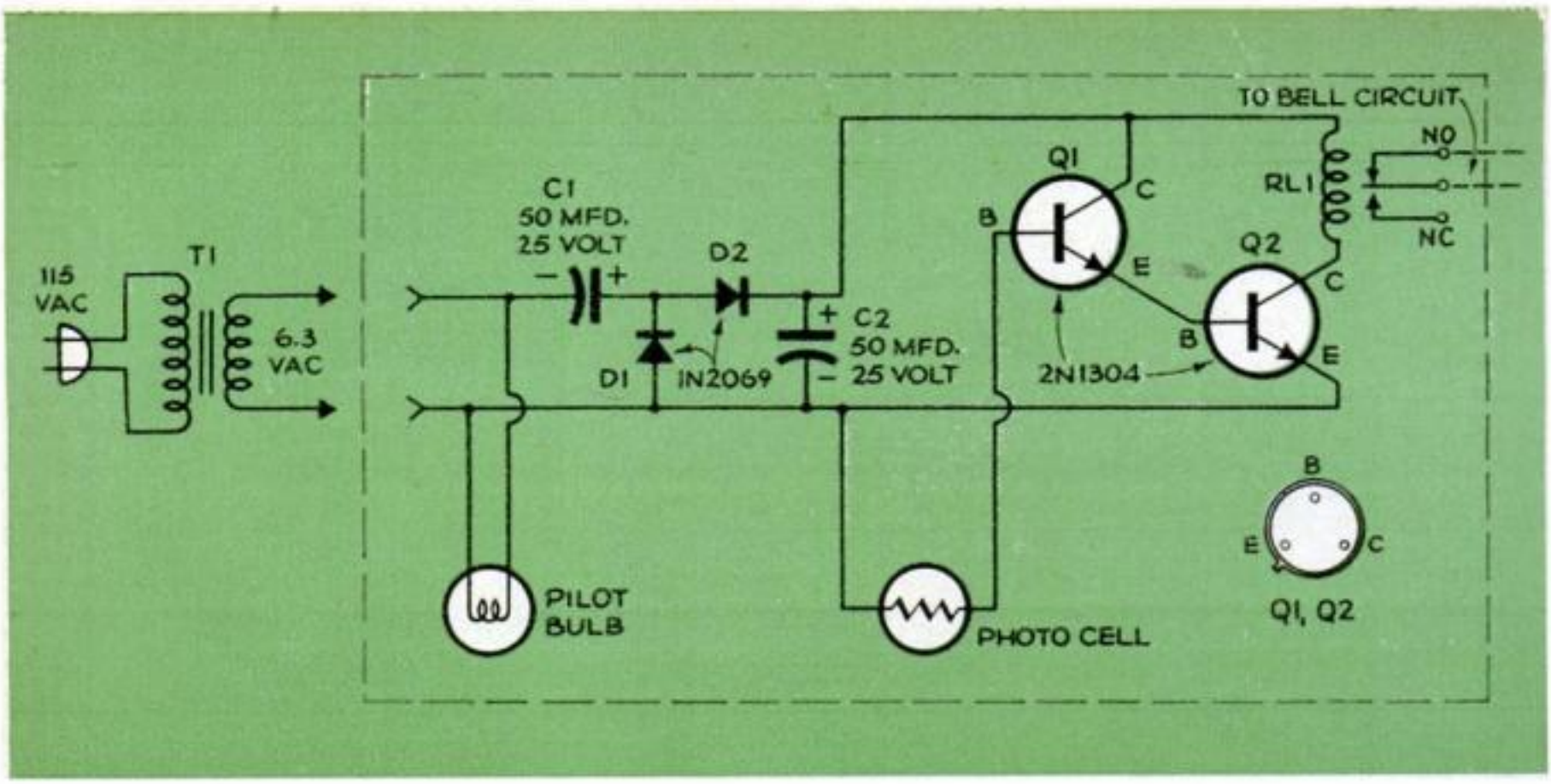
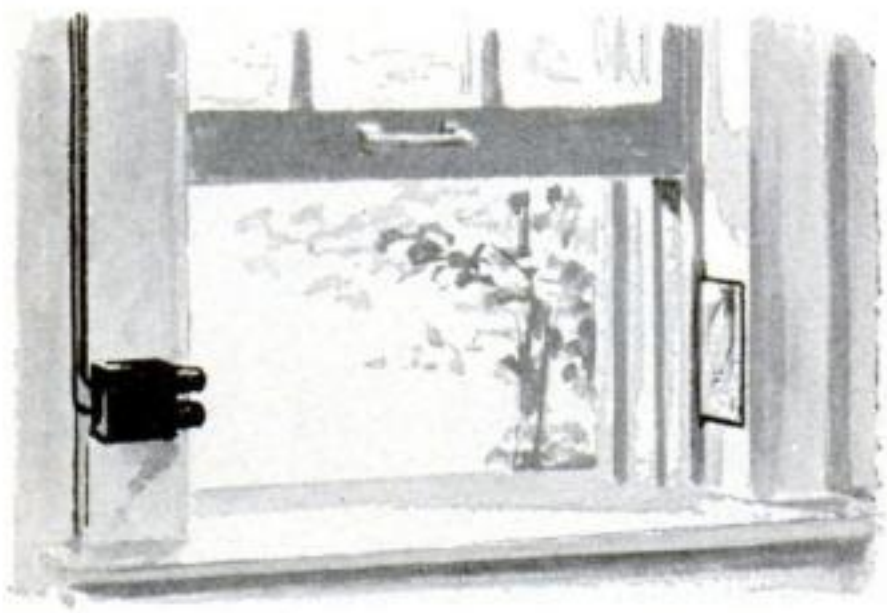


PARTS LIST

C1, C2—50-mfd., 25-v. electrolytic capacitor
D1, D2—1N2069 silicon rectifiers
Q1, Q2—NPN transistors, type 2N1304
RL1—miniature relay, 5,000-ohm coil, SPDT contacts (Lafayette type 99 G 6091 or equivalent)
Photocell—CdS photoconductive cell. (Lafayette type 19 G 2101, or Allied Radio type 8 E 931)
Pilot bulb—GE #259 wedge-base 6.3-v.
T1—6.3-v. AC filament transformer (Stancor P-6465 or equivalent)
Case—miniature Bakelite instrument case, 4"x3" x1½" (or any plastic or metal case of same size). (Available from Allied Radio, Chicago 80.)
Misc.—perforated Vectorboard; flea clips; transistor sockets; two convex lenses approx. ⅝" in diameter (see text). Lenses of this type are available from Edmund Scientific Co., Barrington, New Jersey.

The pilot bulb specified in the parts list is a long-life industrial-type "wedge base" lamp. It should last almost a year in continuous service, so no socket is necessary —just solder it directly to the terminals.

The two identical projecting and focusing lenses ensure a bright, concentrated light beam. Any small-diameter convex lenses will work. You can probably find suitable ones in your local dime store.



Want to set a guard on an open window? Drawing shows how. Place photo relay so CdS cell doesn't "see" strong sunlight. Otherwise, cell's light-sensitive surface may be damaged.

Fashion lens mounts out of scrap lengths of metal, plastic, or cardboard tubing. Cement or force-fit the lenses in place.

The spacings between the projecting lens and pilot lamp, and focusing lens and CdS cell, are critical: The lamp and cell should be at the focus of their respective lenses.

To find the exact distance, use each lens to focus the image of a lit table lamp (the lamp should be over 10 feet away from you) onto a sheet of white paper. The distance between lens and paper that produces the sharpest image will probably be two or three inches.

Position the lenses in their mounts so that they are this distance from the pilot bulb and CdS cell when the mounts are cemented to the Bakelite case and the chassis boards are installed.

Warning signal. Most low-voltage (6-12 volt) bells, buzzers, or lamps will work, as long as they don't need more power than RL1's switch contact maximum rating of ½ amp. Wire the warning signal in series with the relay's *normally open* (NO) contacts and a suitable power source (batteries or low-voltage bell transformer). ■■

Urheberrechtlich geschütztes Material

Dashboard Tape Player for Highway Hi-Fi

WHO wants a stereo hi-fi system in his car? You do—at least, that's what Ford, RCA, and the Lear Jet Corp. are betting.

The Lear-developed unit (in photo above) is a combination AM radio and tape player that fits into the same dash space as a conventional car radio. In place of the usual station-selector pushbuttons, there's a slot. Just slip a prerecorded tape cartridge (below, right) into the slot, and the unit plays 80 minutes of stereo music.

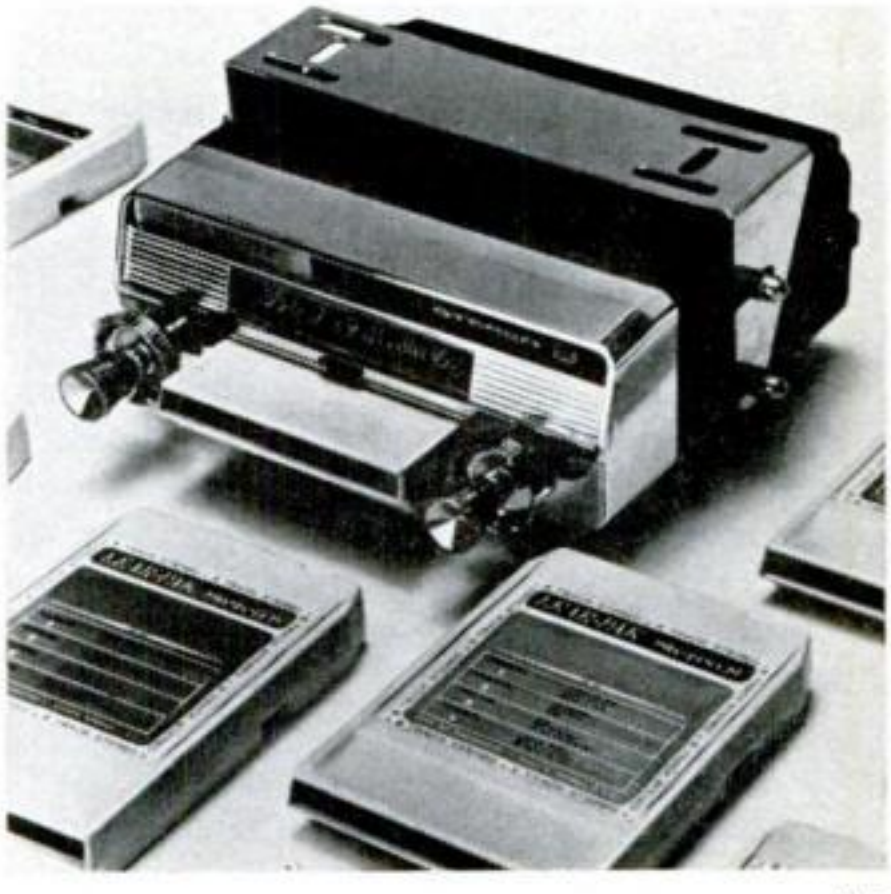
There's no threading: You can insert the cartridge without taking your eyes from the road. Withdraw the cartridge, and the unit automatically turns back into a radio.

Ford will offer the player/radio as an option on their 1966 models; RCA plans to distribute most of their LP record selections on prerecorded cartridges.

An 80-minute cartridge is equivalent to two 33⅓ LP records, and will cost $10.

Speakers? Four wide-range units are built into the car doors. The player has dual five-watt transistorized amplifiers.

An under-dash player (below) that can be mounted in any car will be available late this fall. It will cost $179 ($159 without a built-in radio). Lear Jet Co., Box 1280, Wichita 1, Kan.



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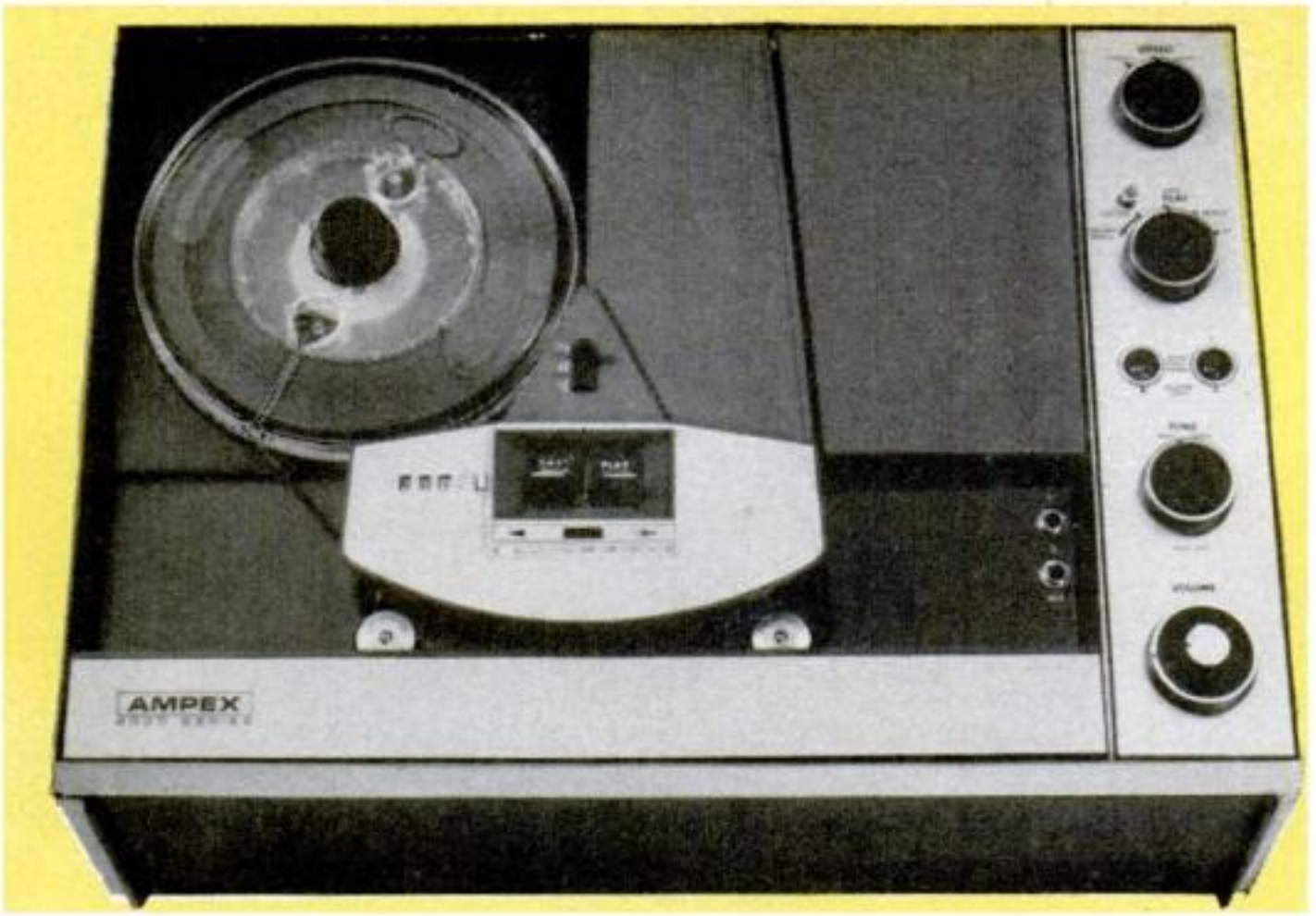

- Single-knob tone control
- Dual neon-bulb recording-level indicators
- Automatic reversing at end of reel
- No instant stop or cuing button
- No sound-on-sound or echo
- Tape heads held in rigid block to maintain azimuth adjustment

AMPEX 2070

Threading is fully automatic; just drop the tape leader into the slot on the gray panel.

PS ELECTRONICS

Inside the *New*

Whether you love music or gadgets—or both—there's a machine now that will do what you want, and do it magnificently

By Ronald M. Benrey

When the first home tape recorder appeared, just after World War II, many audio experts—and more than one electronics editor—predicted magnetic tape's easy triumph over the phonograph record:

"One day soon, a tape recorder—not a phonograph—will be the heart of your hi-fi system."

Rediculous? No . . . just premature. The versatile LP shrugged off every challenge the young science of tape technology could muster, including stereo reproduction.

Now, the *new* tape recorders may make the prediction come true—by beating the phonograph record at its own game. In addition to their ability to make recordings, the new recorders can top phonographs in every kind of playback application. One by one, the major shortcomings found in early home tape machines have disappeared.

Inconvenience. Today's automatic tape recorders and cartridge-loading machines are easier to use than a phonograph. Drop a reel of tape, or a cartridge, into the machine, and press the button: The recorder will play several hours of stereo music without any further attention.

Poor fidelity. Modern portable tape recorders are scaled-down professional-caliber machines. Many home-use recorders can outperform the broadcast-quality recorders used by radio stations.

High cost of tape compared with LP records. The latest tape recorders can record and play back full-fidelity stereo, operating at a tape speed of only 3¾ inches per second (i.p.s.)—half that of the traditional 7½ i.p.s. home-recorder speed. Prerecorded stereo tapes and cartridges for this low speed cost about the same as equivalent stereo LP records—and sometimes even less.

CONTINUED

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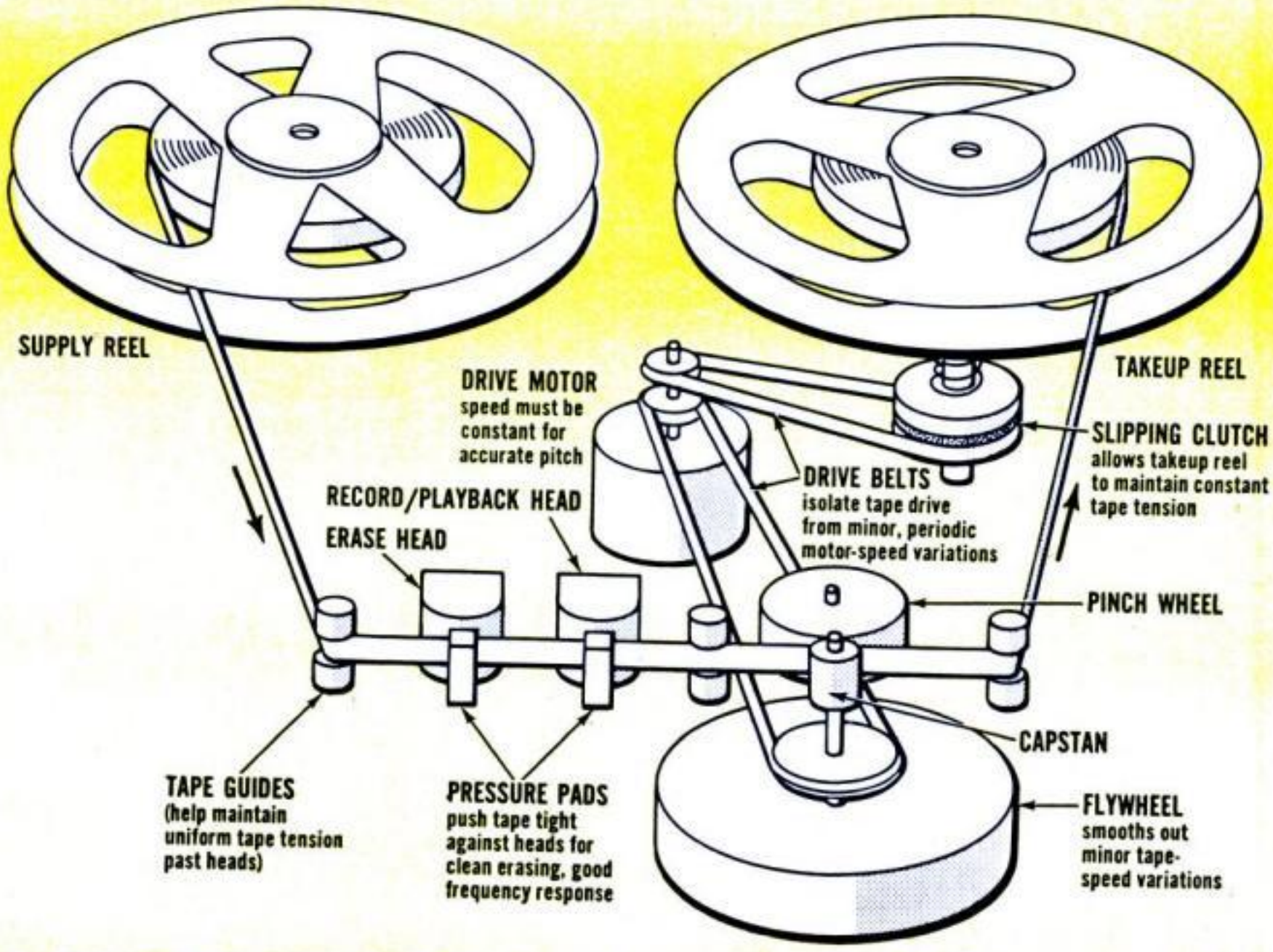
- Dual bass and treble controls
- Dual VU meter recording-level indicators
- Interchange takeup and supply reels to reverse
- Effective instant-stop knob
- Full echo and sound-on-sound
- Tape heads held in conventional bottom mount

DYNACO 2000

No automation—the nearly 30 knobs, switches, levers, buttons, meters all control something.

Tape Recorders

The critical points in a simple tape transport



Urheberrechtlich geschütztes Material

Individual motors—hysteresis-synchronous type—power the capstan, takeup reel, and supply reel, making the transport capable of jackrabbit starts, stops, and tape rewinds.

Making a stereo recording at 3¾ i.p.s. uses up good-quality audio tape at the reasonable rate of about $3 an hour. That makes it economical to build a music library by taping FM multiplex stereo broadcasts.

Tape recorders have come a long way since you used a monaural "family-fun" portable machine, of questionable fidelity, to record Junior's first gurgle. To find out how far, I lived with three brand-new recorders for several months: the top-of-the-line Ampex, Dynaco, and Concord four-track machines pictured on these pages.

As a group, they bring together nearly every tape-recording feature, provision, capability, and accessory available on home-use machines. I chose these machines, instead of other equally fine recorders on the market, because they typify the three different types on sale today:

1. The easy-to-use automatic machine for the nontechnical music listener.
2. The gadget-laden do-everything recorder for the audio hobbyist.
3. The professional-design studio-type machine for music collectors.

Here's what my three recorders offer, in a nutshell:

1. Ampex 2070—a fully automated tape machine featuring automatic threading, and automatic tape reversing at the end of a reel. It plays both pairs of tracks on a four-track stereo tape without flipping the takeup and supply reels. It's the simplest-to-operate recorder I've ever used. Price $470.

2. Dynaco 2000—an audiophile's daydream. Fully transistorized plug-in interchangeable circuits and 19 different audio controls—arranged on a control panel that would do justice to a Gemini capsule—allow it to perform every special effect and tape-editing trick in the book. Price: $500.

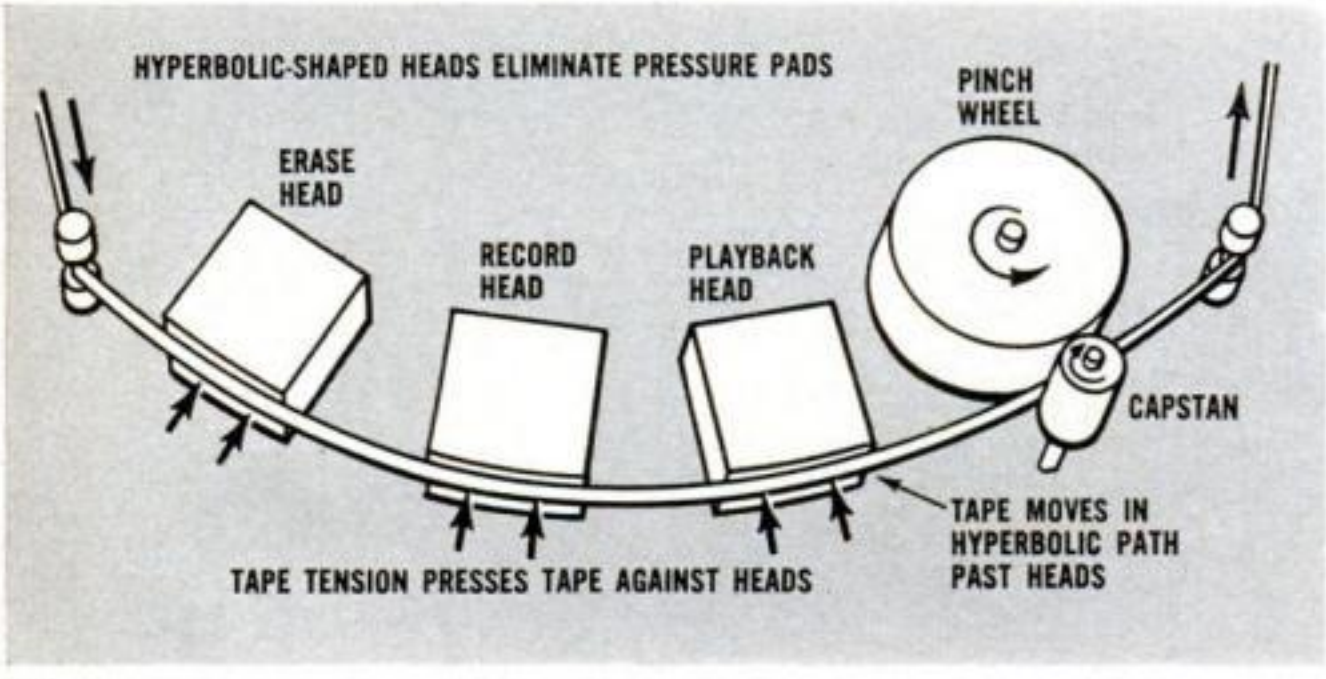
3. Concord R1100—a top-quality scaled-down studio recorder equipped with a faultless auto-reversing three-motor tape transport and an all-transistor circuit. It's an ideal machine for the home music library. Price: $500.

It's no accident that the new tape recorders are specialists—the trend today is away from jack-of-all-trades machines. Each of the new ones is designed to excel at one particular recording job. Here's how:

Replaying a prerecorded tape. This is a deceptively simple task. Tape machines designed primarily to be tape players—such as the Ampex 2070—hide a lot of fancy engineering beneath their simple exteriors.

Some problems arise because most prerecorded tapes are purchased by nontechnical people—they want to listen to good

[*Continued on page 186*]



Pressure pads, which cause wear on head and tape, are used by most conventional recorders to hold the moving tape in close contact with the head assembly. The Ampex and Concord machines both have hyperbolic-shaped head assemblies. The tape's own tension, as it moves over the curved heads, keeps it flush against them without pads.

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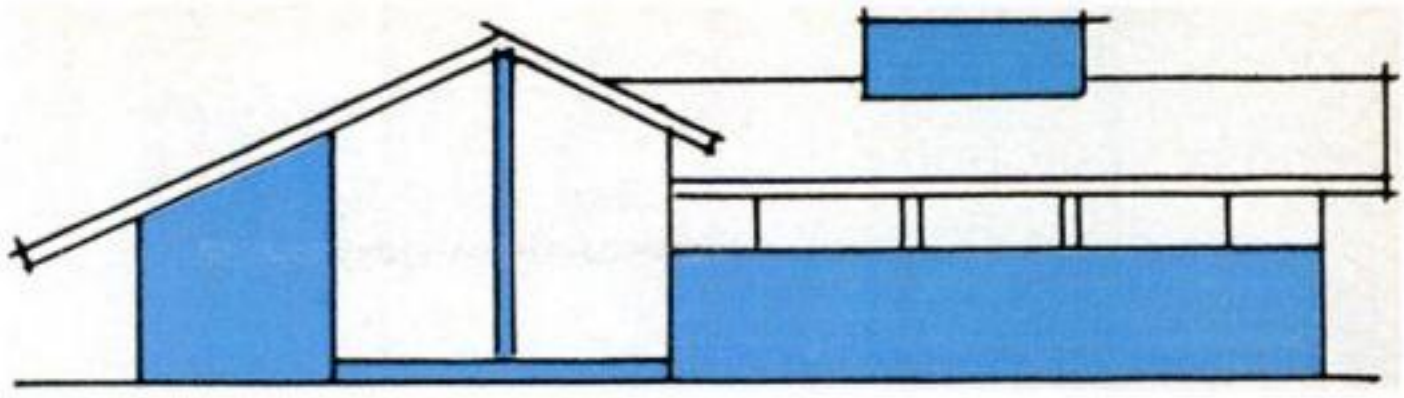

IMPROVE YOUR HOME

48 pages of new ideas for getting more pleasure and comfort out of your particular "castle"

FINDING SPACE FOR A DISHWASHER. Even though yours is a modern kitchen with all space used efficiently, you can still find a place for a dishwasher .....Page 108

FOR A LUXURY FLOOR: NEW WOOD SQUARES. You can easily lay a real hardwood floor over any old flooring .....Page 116

TIPS FOR INSTALLING PLASTERBOARD. When you need a new wall or ceiling, put up plasterboard. Here are some tricks for a faster and better job .....Page 120

NEW ROOFING: BETTER THAN EVER. Now the topping for your house can be stronger and more durable .....Page 126

SIDINGS WITH BUILT-IN PAINT. Planning to paint? Perhaps you ought to think about installing prefinished siding instead .....Page 130

EASY PLUMBING WITH COPPER TUBING. You, too, can save money—like the many home owners who have learned that this job is not as difficult as it seems .....Page 134

PUT IN NEW LIGHTING FIXTURES. Why live with out-of-date illumination when you can change it yourself? .....Page 138

3 STEPS TO INSTALLING CERAMIC TILE. You can enjoy this classic surface for a fraction of the usual costs .....Page 144

CUT YOUR FUEL-OIL BILL UP TO 25%. For an investment of less than $14, you might save up to $100 a year .....Page 148

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IMPROVE YOUR HOME

5 Ways to Find

By Herbert R. Pfister

MENTION buying a dishwasher and the women in your home will probably jump with joy. But your glow of satisfaction might turn to a frown of frustration when you start to think about just where you'll put the machine.

A portable model stands idle most of the day, filling more than four square feet of kitchen space that can't be spared in most homes. A clear path must be provided, too, to roll the unit from its corner to the sink so that it can be connected to the faucet.

Sure, you can boldly rip out a cabinet beneath one of the work counters and install a built-in model. But you'll have to relocate the groceries, the mixer, and the pots and pans, already bursting out of their present storage places.

Tucking a dishwasher out in the pantry, laundry room, or garage cancels out its laborsaving feature—it's too far from the action. Carrying stacks of dirty dishes

1 When you have a large kitchen, a set of cabinets built as an island in the center of the room will give the effect of a major remodeling job. Install the dishwasher as near the sink as possible and fit cabinet doors on the remaining sides. The island can be made doubly useful by removing the cooktop from its present location and dropping it into an opening in the island top. The remaining space in the counter might be covered with a cutting board. An overhead exhaust will complete the transformation and carry cooking vapors out of the house.

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Space for a Dishwasher

around the house is almost as much trouble as washing them in the sink. So the dishwasher *must* be located in the kitchen.

Sound hopeless? Not at all. POPULAR SCIENCE editors have come up with not just one, but *five* space-saving ways to build a dishwasher into your kitchen without sacrificing a precious storage cabinet. Two of these installation ideas put the machine in the kitchen wall with little loss of floor space; the three remaining recommendations actually provide additional storage space and new convenience while enclosing the dishwasher.

Having the dishwasher close to the sink is desirable only for minimum back-and-forth traffic when scraping dishes and loading them into the machine. A few feet of copper piping can be run between the floor joists to connect the dishwasher to the hot-water line and drainpipe in the basement. Instructions for plumbing and electrical hookup come with the machine, but local laws may require professional installation.

2 When there's a closet adjoining the kitchen you have a ready-made solution to the dishwasher space problem. Cut an opening in the wall and set the dishwasher in the closet with its front panel flush with the wall on the kitchen side. Frame the machine with wood molding to conceal the cut edge of the plaster or wallboard. Built-in models stand about 34" high, are 24" deep, so jackets can be hung above the machine, leaving part of the closet for coats and other long garments. For a neat job, box in the rear of the dishwasher with ¾" plywood.

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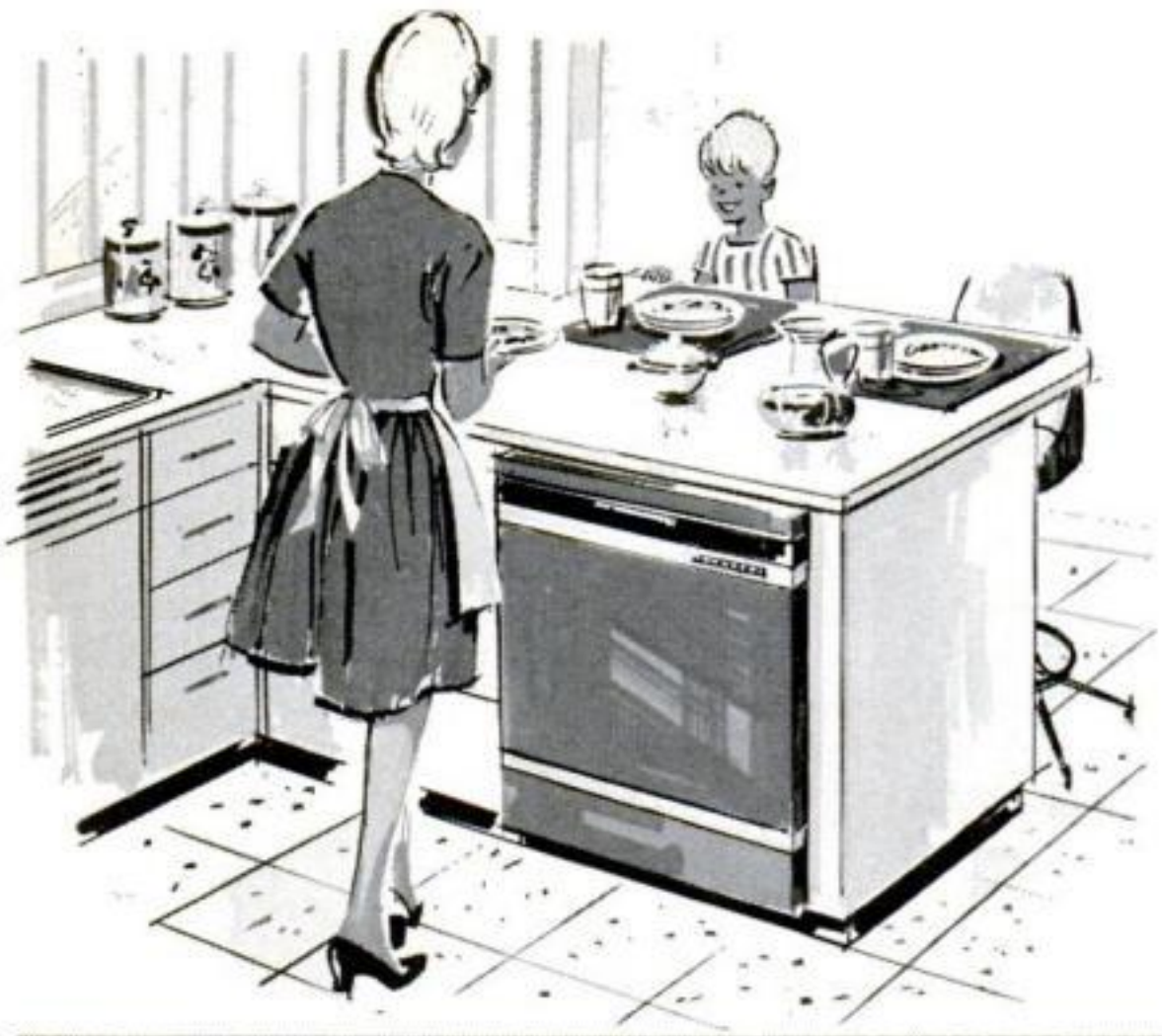
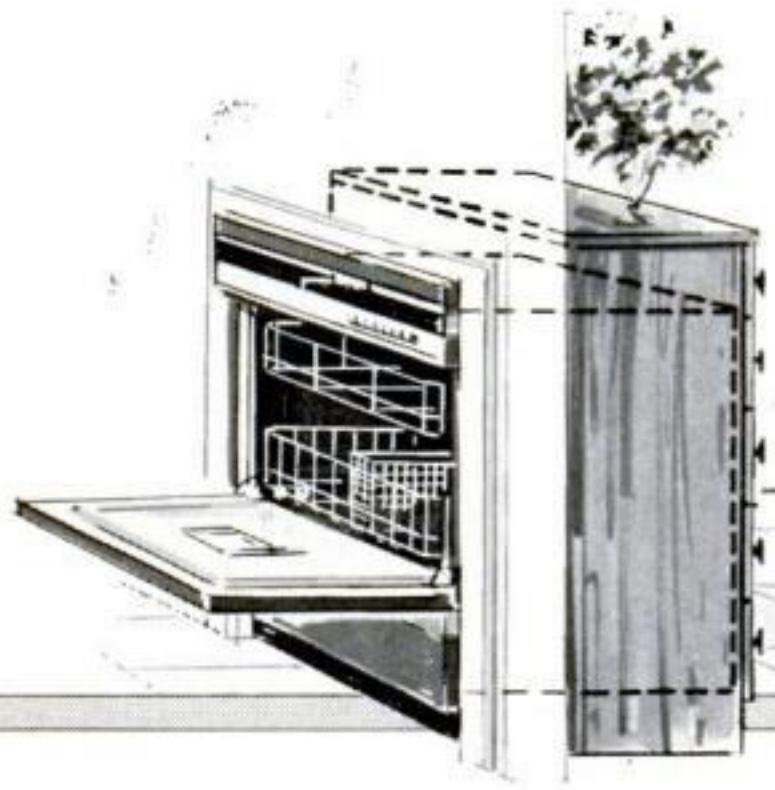


3 **A peninsula cabinet** that doubles as a breakfast or snack bar can be built to extend existing cabinets part way across a wide entrance to the kitchen. With a little more effort, a narrow doorway can be widened to make room for this functional kitchen feature. If space permits, the peninsula can be made longer than the width of the dishwasher to provide extra storage space on one side. Stools for the breakfast bar should blend with the decor of the room outside the kitchen, since they will become a part of that room.



4 **Any dishwasher** can easily be set flush in the kitchen wall with its rear (minus the wall thickness) protruding into the dining, living, or family room on the other side. Very little time, effort, or craftsmanship is required to cut an opening in the rear of an unpainted cabinet or other large piece of furniture so that it can slide over the rear of the machine to conceal it. Remove drawers; glue the faces back on.

5 **A pass-through opening** in the wall between the kitchen and family or dining room provides convenience and a compact dishwasher housing. Center a cabinet and counter on the wall line so that one half of the cabinet is in the kitchen, the other half in the next room. Each half will pro.rude less than 15" into either room. Building the cabinet about 30" longer than the width of the machine will add 15" of storage space on each end, making the cabinet and pass-through about 4½' long. ■ ■

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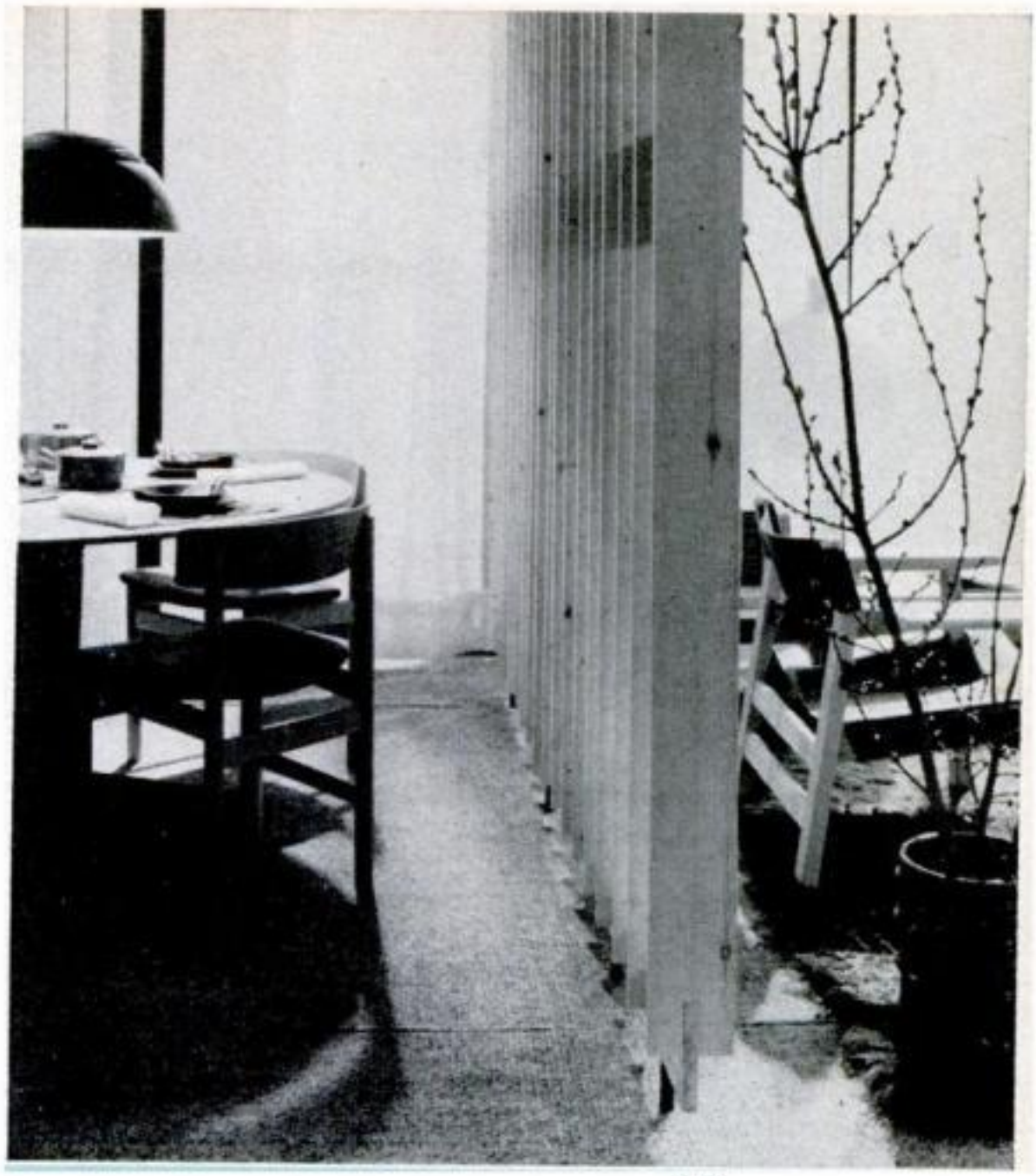
IMPROVE YOUR HOME

A See-Through Room Divider You Can Build

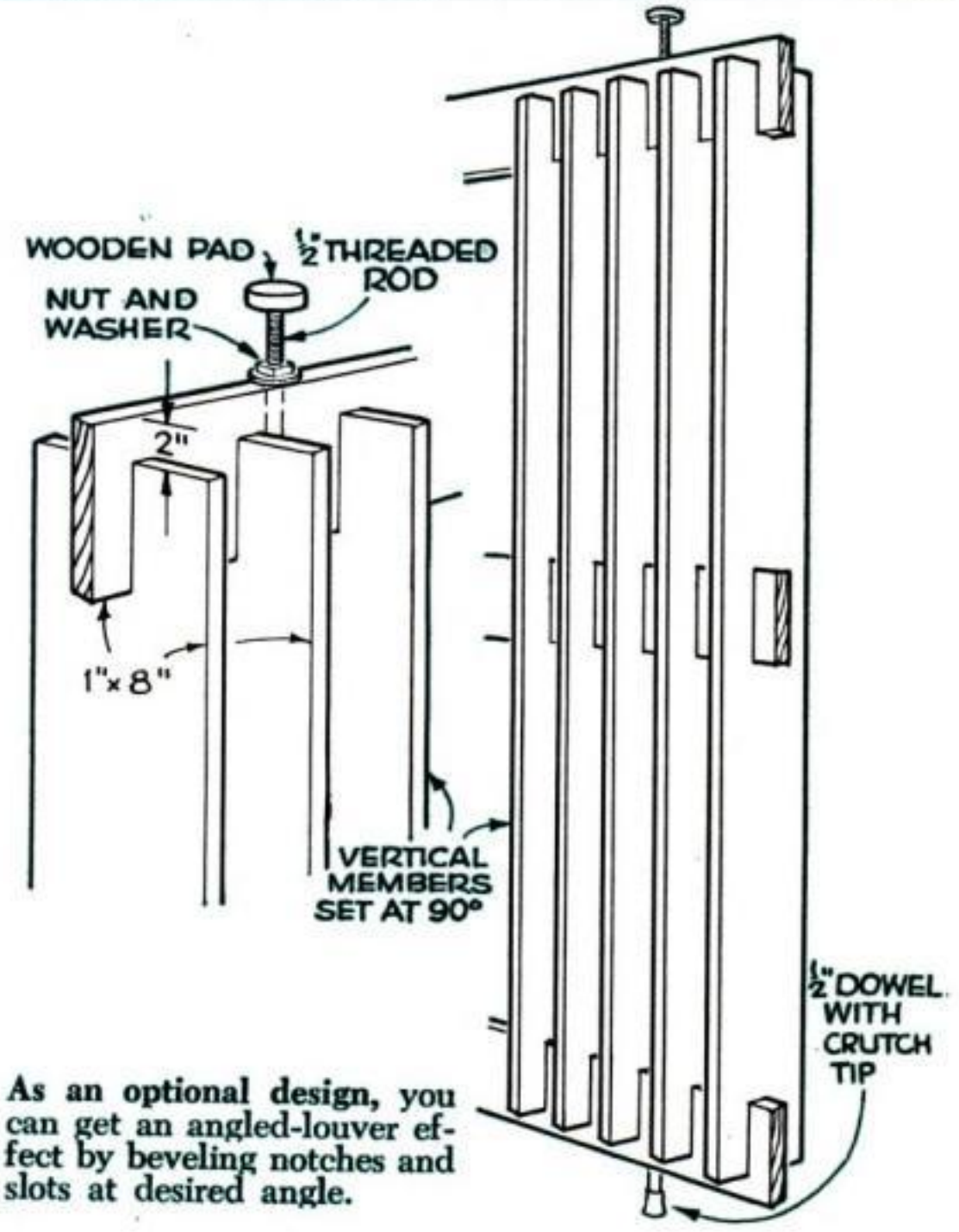


THIS excellent design in a room divider can be as simple (and cheap) as No. 2 pine or as luxurious as select mahogany.

You need a one-by-eight for each 6″ of divider (all pieces should be 6″ shorter than the height of the room). In addition, you need three one-by-eights for the horizontal members.

Cut notches in the ends and a slot in the center of each vertical, to accept the horizontals. Keep these joints snug; toenail together.

Drill three evenly spaced ½″ holes in the edges of top and bottom horizontals to take the supports. For bottom supports use ½″ dowels. Make top supports as shown in the sketch. To erect, simply level the divider and tighten nuts until the divider is wedged snugly between the ceiling and the floor.



As an optional design, you can get an angled-louver effect by beveling notches and slots at desired angle.

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IMPROVE YOUR HOME

Study Corner That Grows

Desk rests directly on the floor, as shown at right, for the kindergarten-primary ages. A few years later, add legs, as below, to adjust for the child's growth.

By Robert Hoppough

AS YOUR child adds inches, year by year, you add inches to this study corner. The trick is in periodic replacement of the legs with a new set a little longer than the last. Meanwhile, the glass-door display case moves up the wall above the desk.

Basic construction is plywood, with the top covered and edged with a plastic laminate. If you pick a cabinet-faced plywood, you can put on any good clear finish. This one is fir, painted with semigloss. The accent is gold, brushed into half-round routing on the end panels, and around the door, drawers, and top.

The wall cabinet is interesting for the bench-type shelf inside, which rests on the bottom and can be lifted out.

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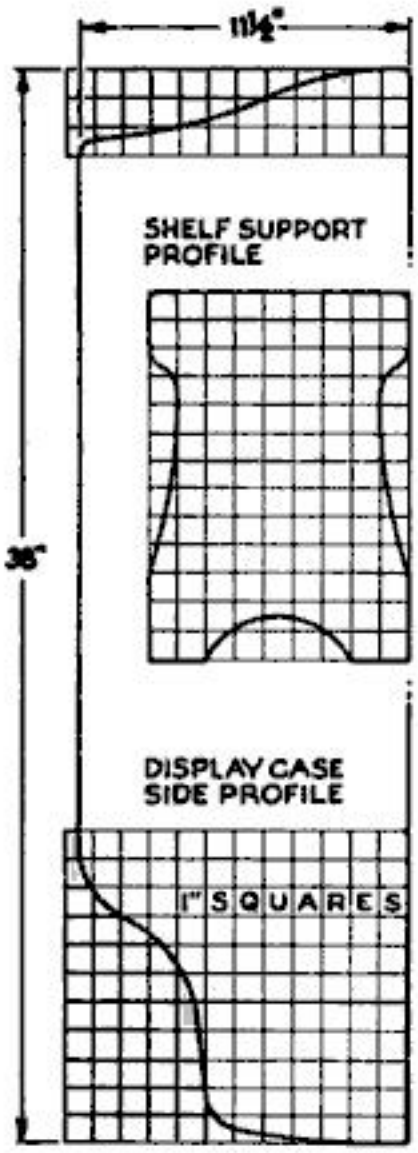
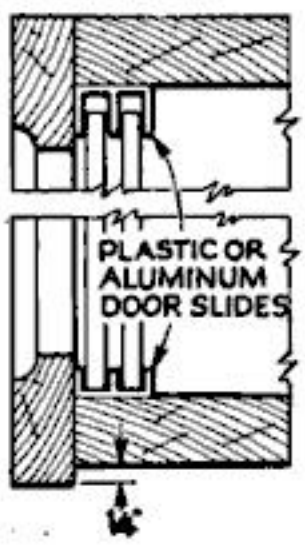
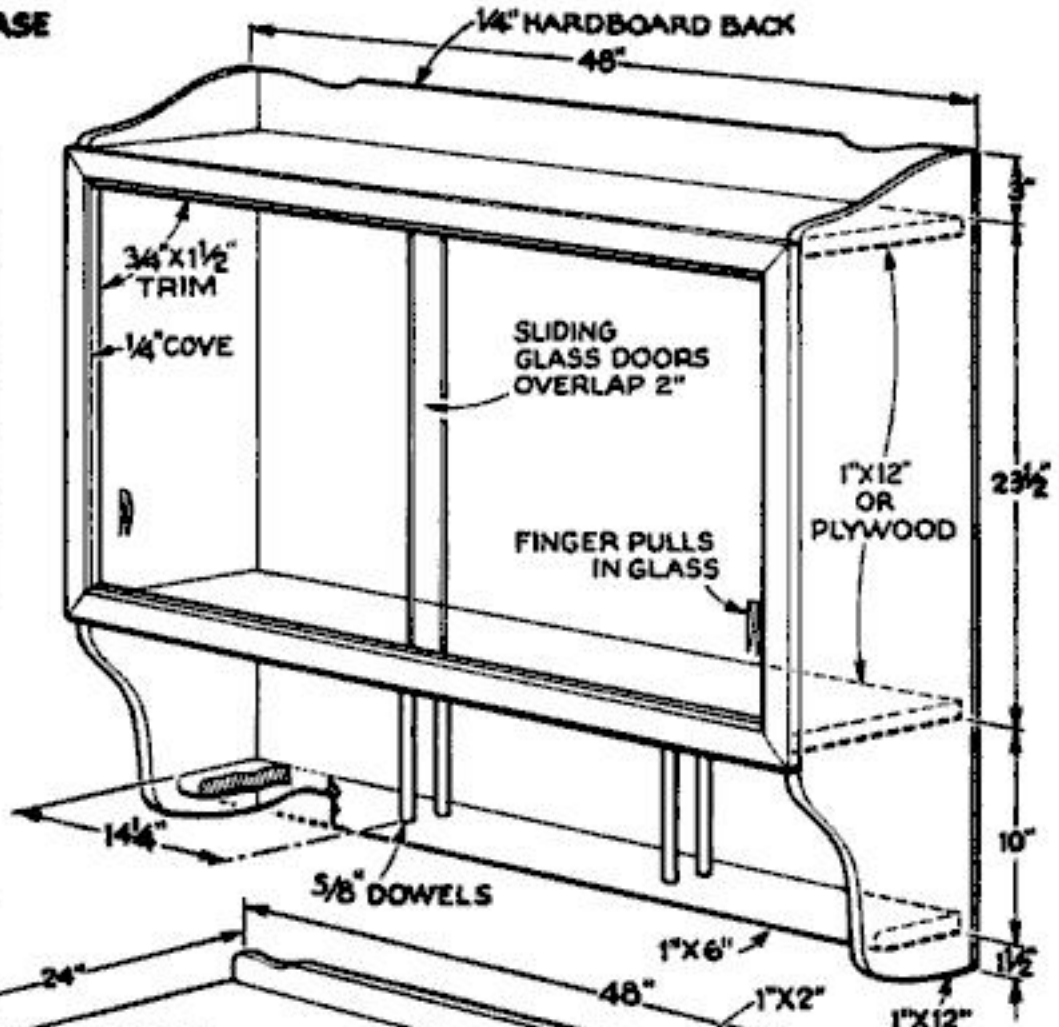
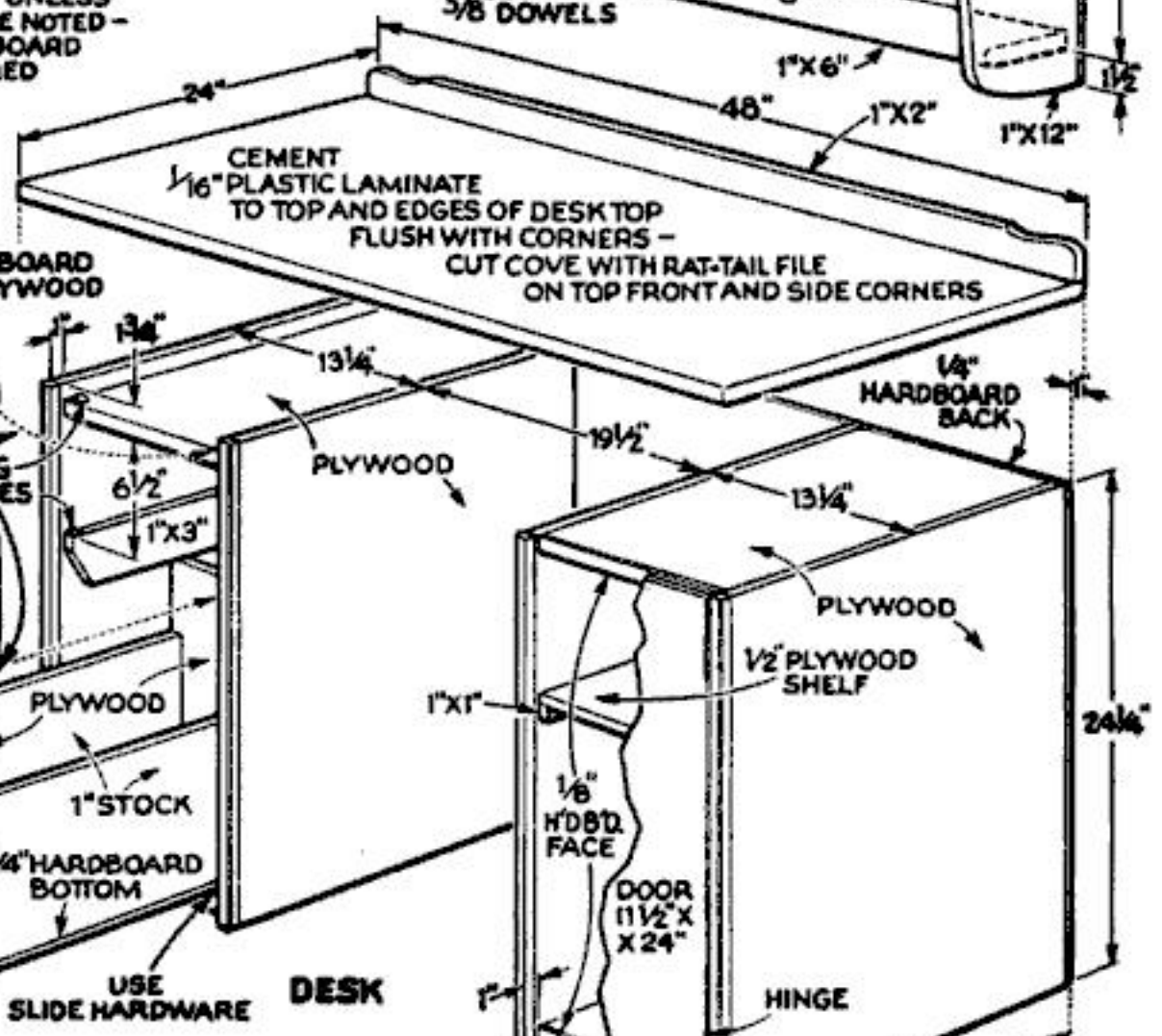
HOBBY DISPLAY CASE

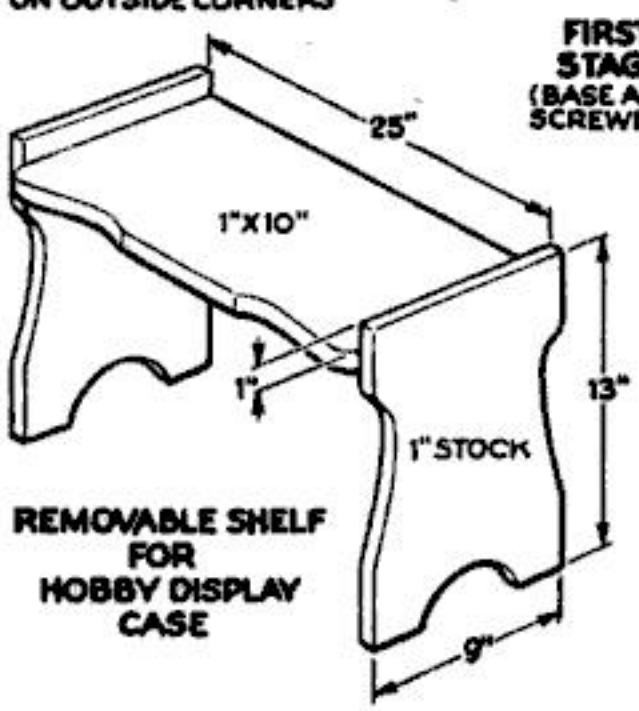


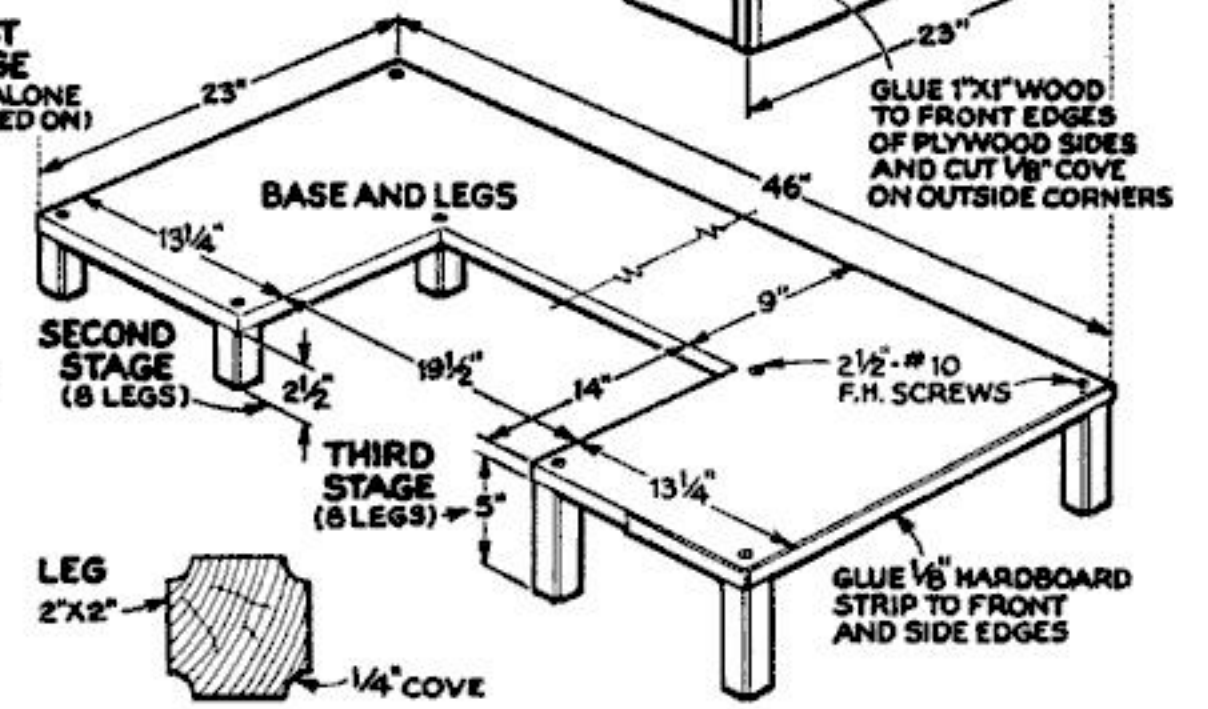


NOTE:
ALL WOOD IS 3/4" PLYWOOD UNLESS OTHERWISE NOTED – ALL HARDBOARD IS TEMPERED









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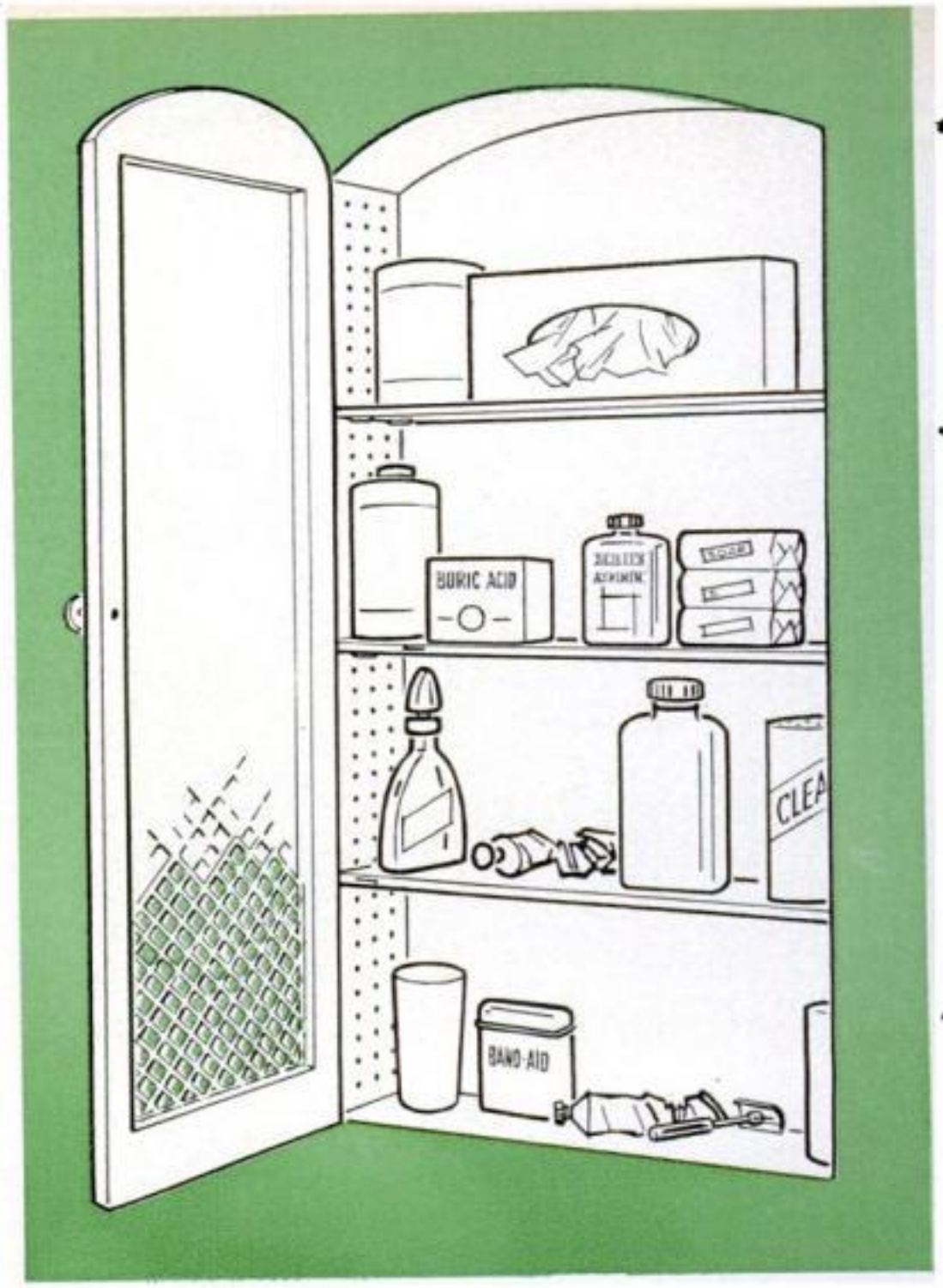
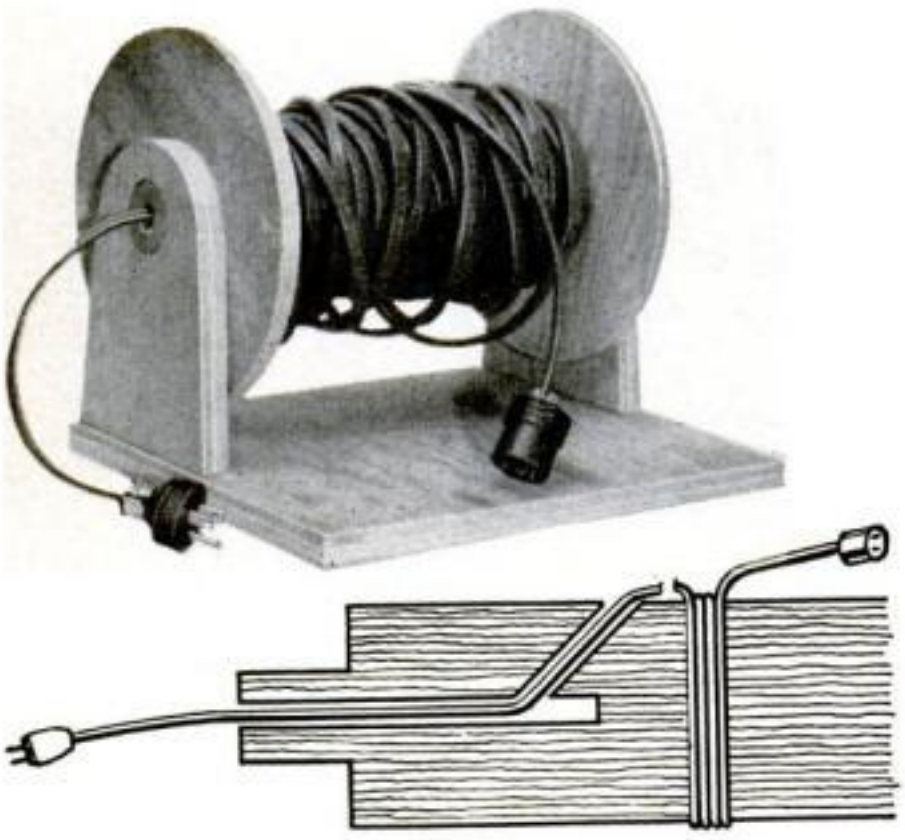
IMPROVE YOUR HOME

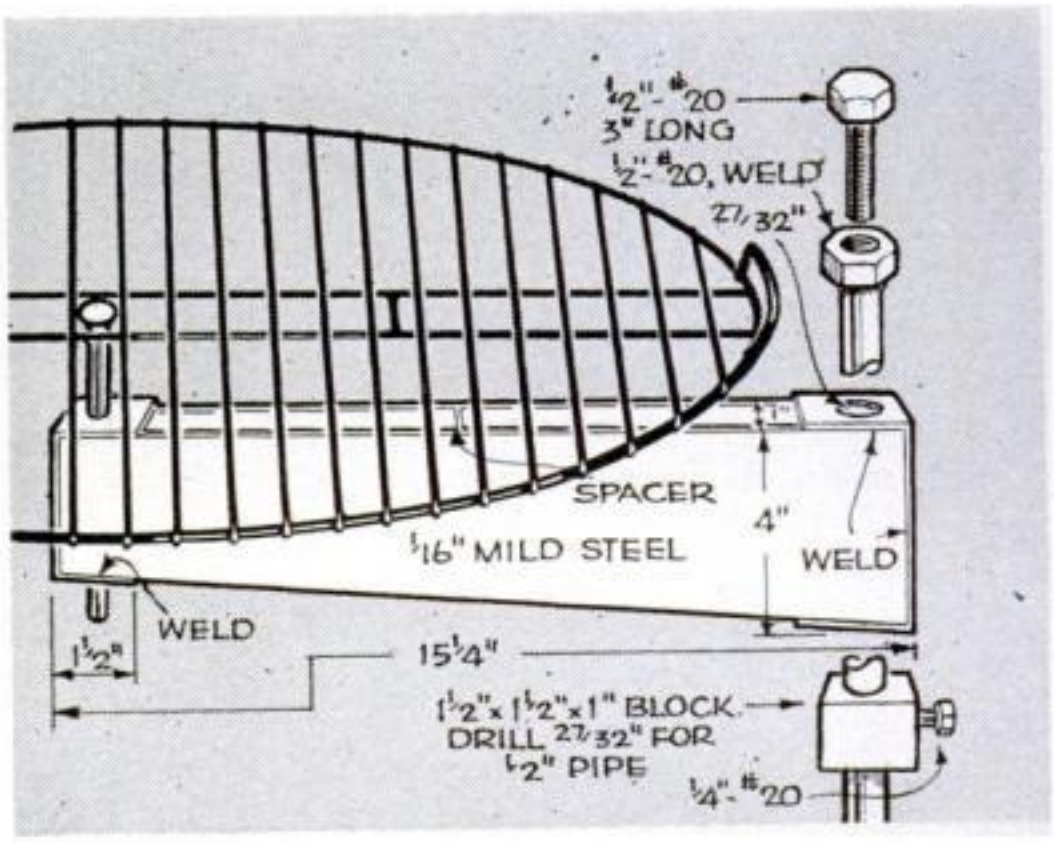
6 Quick and Easy Projects for Home Handymen



1 New bathroom cabinet. Extra storage space can be gained by building a recessed cabinet between wall studs. For a handsome interior, use wood-grained hardboard, with matching perforated hardboard on the sidewalls. Bend ¼" hardboard to make the arched top. Fit wood dowels into the pegboard for glass shelves. Groove the door frame to hold filigree-patterned hardboard.—*Henry Adams, Chicago.*



2 Extension-cord reel. You can forget about untangling your extension cord each time you use it if you build this reel. It's particularly useful for long cords like those for electric yard tools. Cut pieces for the stand and reel disks from ¾" plywood. Make the reel axle from a piece of closet pole. Drill into one end of the reel axle, then at an angle through the side as in the sketch. Wind and unwind the cord while it's unplugged to prevent twisting on the reel. —*Jackson Hand, Westport, Conn.*



3 Indoor barbecue. Don't let your enthusiasm for barbecue dishes be dampened by rain or cooled by wintry blasts. If you have a fireplace, you can build this grill for use indoors. Cut pieces for the arm from a sheet of 1/16"-by-9"-by-15" mild steel, and weld together. The post is ½" pipe cut 2" shorter than the fireplace opening. Install at one side of the fireplace opening and wedge-bolt against the fireplace top. Coat with black stove paint.—*Ray Ayers, Oxnard, Calif.*

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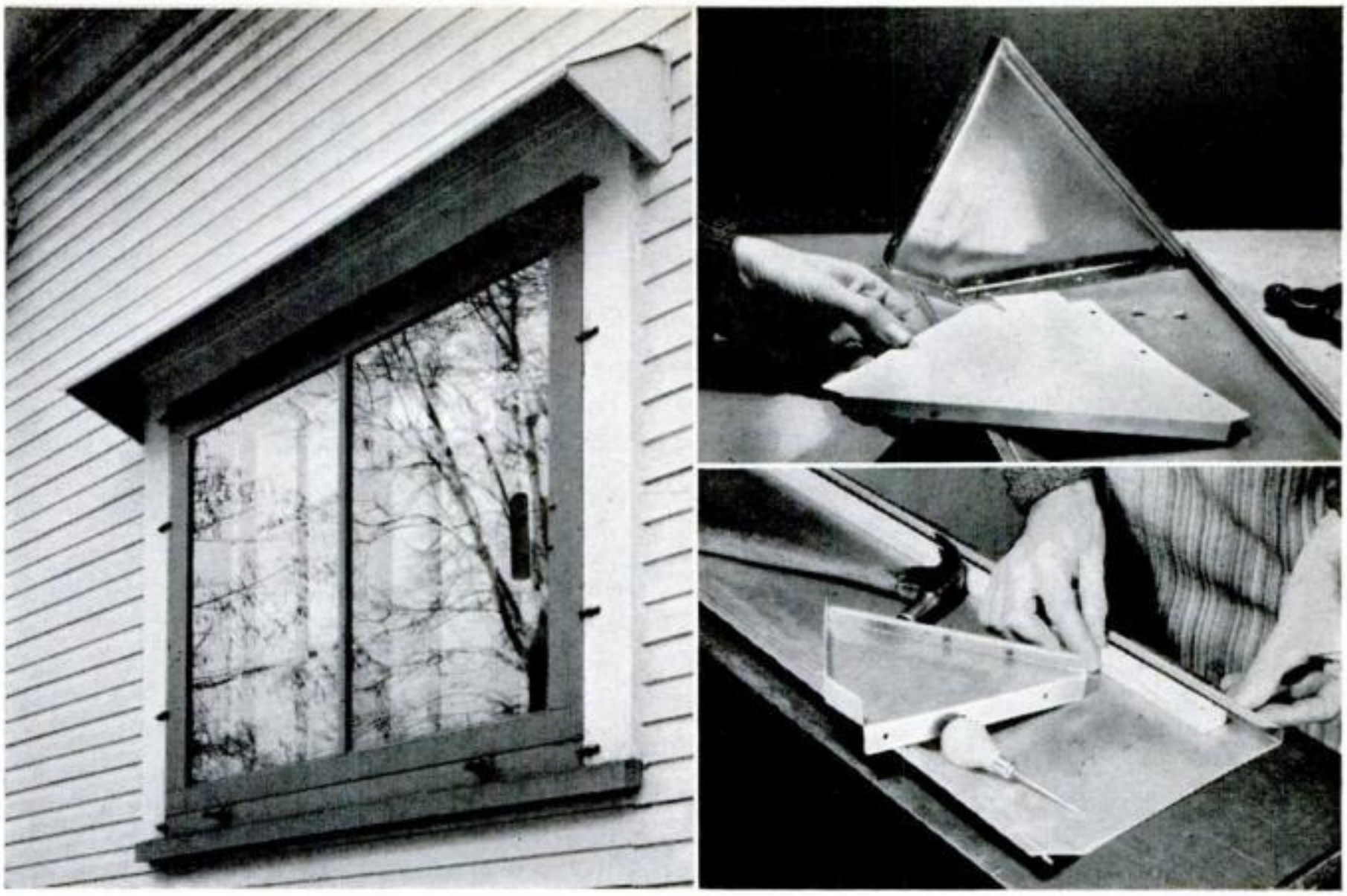
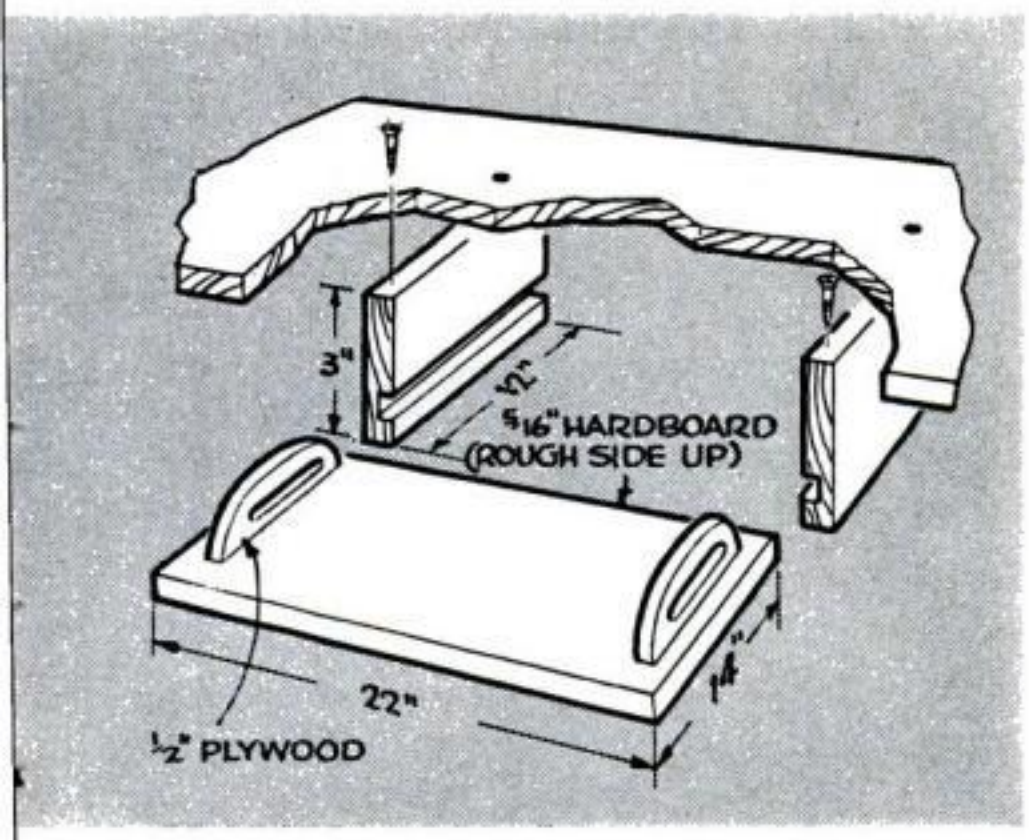
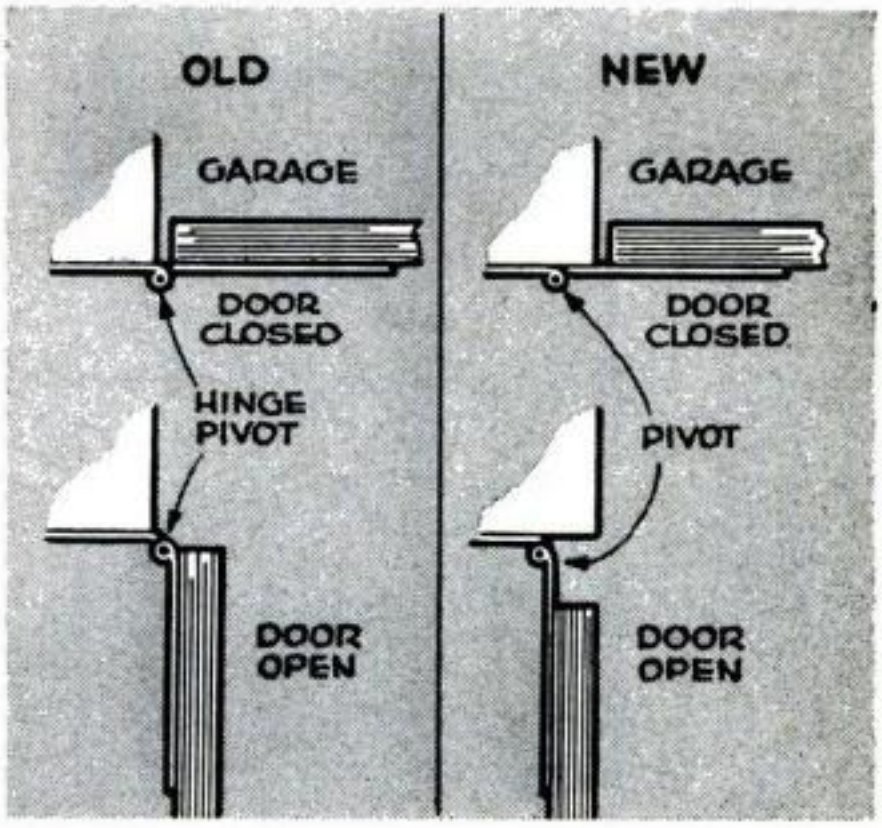


4 Window awnings. Slim ones like this will keep out rain when the window is opened slightly for ventilation, prevent water from seeping over the top of the storm sash, protect the glass against falling ice, and improve the looks of the window. The awnings are made from aluminum house siding. Cut endpieces from scrap lengths as shown at upper right. Stiffen the awning by inserting a strip of painted wood into the lower channel of the siding, as at lower right. Bend siding to the shape of the endpieces and assemble with rivets. Attach to house with aluminum screws and caulk around top and edges.—*Walter Burton, Akron, Ohio.*



5 Table-mat storage tray. My wife has several sets of table mats. To get storage space for them, I made a tray that slides out from under the linen-closet shelf and can be carried to the table for place setting. I used the rough side of the hardboard up and did not varnish it. This keeps the mats from sliding off. The plywood handles, however, are varnished. The slides are made of 1" pine with a ⅜" rabbet, and are screwed to the underside of the closet shelf.—*H. Betts, San Francisco.*



6 "Widening" a garage. When I bought a newer—and wider—car, I had to run the gauntlet through the old garage doors with only 1½" to spare on each side. While shuddering at contractors' estimates for a new overhead door, the answer came in an inspirational flash. I moved all the strap hinges back from the edge of the door frame, so that the doors would swing clear of the opening, giving inches more of clearance. For strength, I added a hinge to each door.—*Oric Colyer, San Francisco.*

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Wood Squares Give You a Luxury Floor Fast

Tired of your old asphalt tile? Or other flooring? Here's how to cover everything up with no trouble at all

By Darrell Huff

OUR floors were a lot of trouble to keep up. As in many houses built in the 1950s, the asphalt tile had grown dingy. It was a happy discovery that I could cover them with handsome oak-block flooring without having to pry up the old tile. With modern adhesives, new wood flooring of this kind can go right over almost any old flooring. Since these laminated oak blocks come prefinished and waxed, the floor is ready to use as soon as it's down. It needs only an occasional waxing.

The blocks go down with mastic, spread with a notched trowel. That's what makes the job easy to do.

Start by taking up the shoe mold at the baseboard. Then prepare the old floor. Here's how:

Asphalt tile. Scrub thoroughly to remove all of the wax. Remove any loose tiles and level the space with the latex patching cement that flooring dealers sell.

Concrete. Grind down any high spots with a coarse abrasive stone. Fill low spots with patching cement. Sweep carefully, then prime. If dampness may be present in on-grade concrete, spread a thin layer of mastic (100 square feet per gallon) plus a layer of two-mil polyethylene film. Bring the film up behind the baseboards if possible. Then spread mastic for block flooring.

Painted concrete. Scrub it clean. Spread mastic and lay one block. Check it for adhesion in the morning. If it sticks—go

How to prepare the subfloor for wood blocks

Level up low spots with latex patching cement. Sand or grind down high spots and bumps.

Re-cement loose tile. Remove broken tile and fill the holes with floor-leveling compound.

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ahead. If it comes up, try other types of mastic or remove the paint entirely.

Plywood. Be sure it's nailed down tight, usually at 4″ intervals along edges and 8″ throughout. Check for high spots and sand them down. Scuff-sand any painted areas.

Wood floors. Scrub away the old wax. If floorboards are warped, cover with a well-nailed underlayment of hardboard or ¼″ plywood.

Establish a guide line across the center of the room. Lay down a single row of blocks from the center point to the wall, starting with the first block centered on the center point. If you end up with less than a half block at the wall, start with a joint at the center point and you will get a larger block along the

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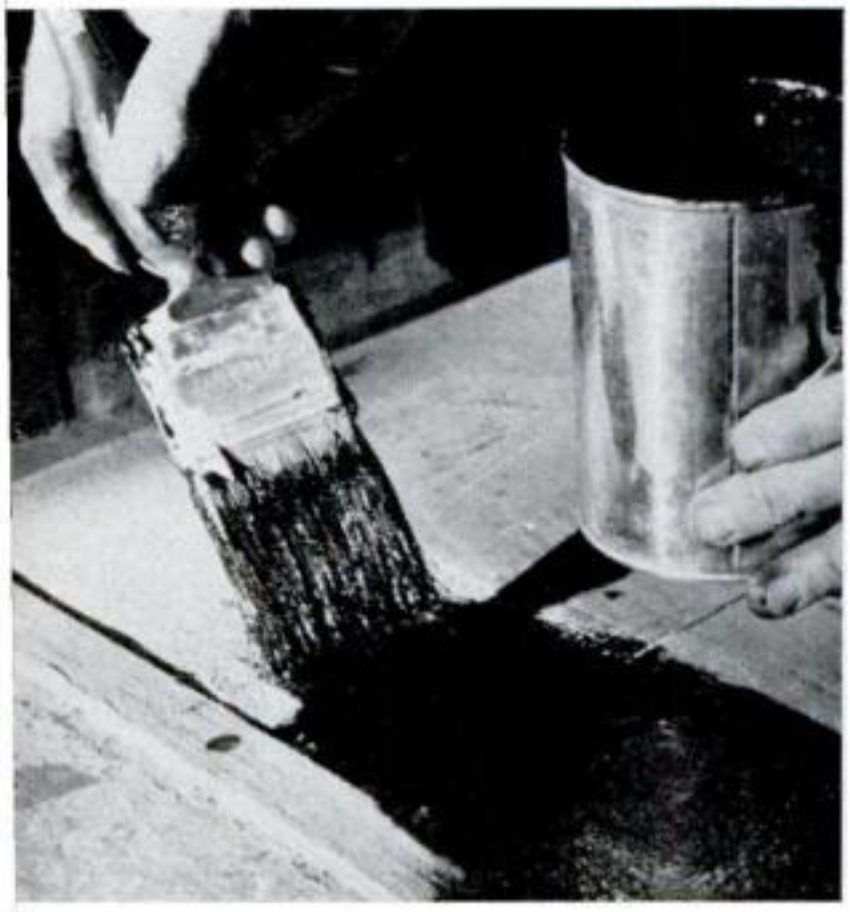
Brush primer supplied by the maker of the blocks on areas of bare concrete.



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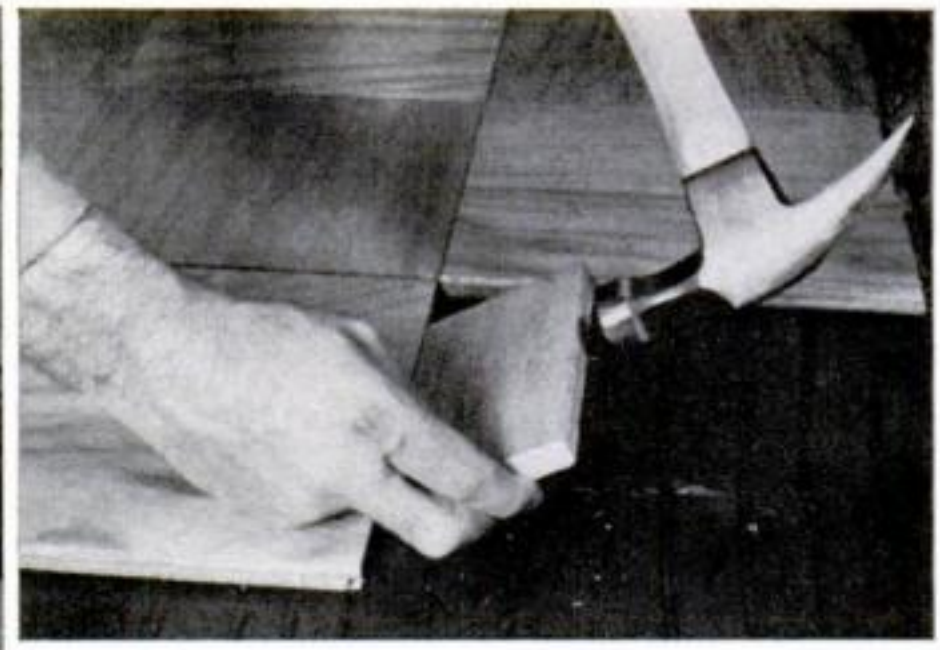
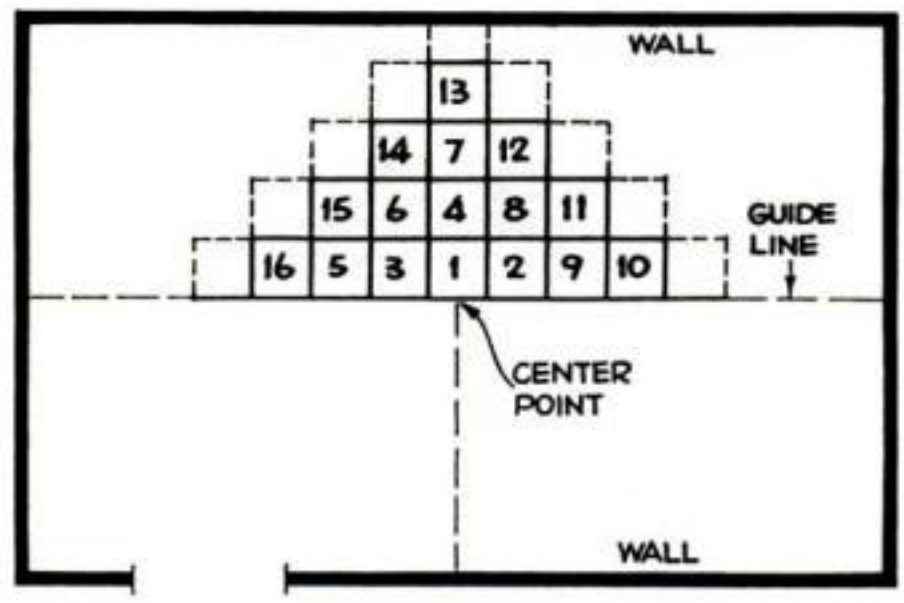
How to lay wood blocks





Trowel on mastic about two hours before laying the blocks. Snap blocks into place as shown above with a minimum of sliding. Use a scrap piece with a tongue or groove to drive blocks into place as in top right photo. Starting from the center point, lay blocks in sequence at right. Spread mastic and lay blocks on one side of the guide line first, then do the other side.

wall. You'll have less waste and the border tiles will be an even width.

You can buy a notched mastic trowel, but you can make one from an inexpensive plasterer's trowel. File V notches on ½" center, making them 3/16" wide and ¼" deep.

Be sure the room is well ventilated, then spread mastic over all the area to one side of the guide line. Lay blocks from center of the guide line towards the walls. Use mineral spirits to remove any mastic that sneaks onto the surface of the blocks.

Fit blocks around obstacles and up to walls as closely as possible. Except in very large rooms, no expansion strips or spaces at the walls are needed. To shape the blocks, use any woodworking tools. A band saw is especially useful.

Round up everybody and put them to work trampling down the installed blocks to insure good adhesion. A conga line works well.

Complete the job by installing oak nosing strip wherever needed to overcome any difference in elevation at doorways. Replace the old shoe mold or install a new one at the walls. Both nosing and shoe mold are offered in prefinished oak.

At a cost of less than 40 cents a block, laminated oak floors are in the same cost range as cork or solid vinyl. A manufacturer is E. L. Bruce Co., Memphis 1, Tenn., and the blocks and adhesive are stocked by flooring dealers in two shades —light and dark. ■ ■

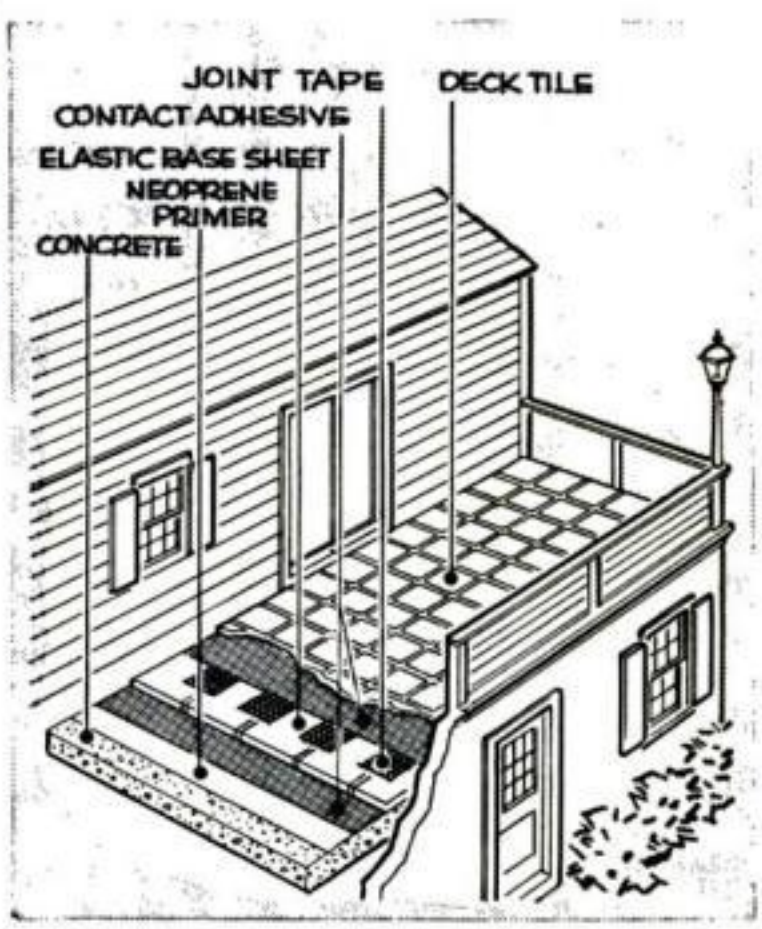
Urheberrechtlich geschütztes Material

IMPROVE YOUR HOME

Two New Products for Covering Floors

Resilient tile now made for outdoor use

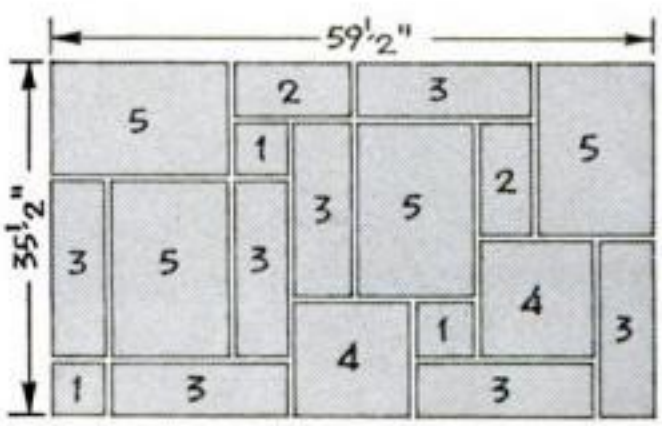
You can now floor a deck or porch with resilient tile. Armstrong Cork Company has just announced the first such tile, specially formulated for use outdoors. It's applied over an elastic membrane that waterproofs the surface underneath. The sketch at right shows a typical installation on concrete. Installation is the same over wood, except for the prime coat (required on concrete). The 18″-square tile has a natural slate finish and comes in four colors—terra cotta, spruce green, slate gray, burnt olive.



Man-made flagstones in modular sizes are easy to put down

Planning to lay a flagstone floor in an entranceway, den, or recreation room? You might want to try a paving that's cast in modular sizes. In the sketch below, the module is No. 1 and all other pieces are multiples of this basic size. Cast from cement, sand, and other materials, the paving is a product of Emco/Electromatic Mfg. Corp., Reading, Pa. The sketch shows how 18 pieces in a typical package combine to cover an area approximately 3′ by 5′. Cost: 45 to 60 cents a square foot. The paving comes in a range of colors.

Typical package contains these pieces:
1: 5½″ x 5½″ 3 pcs.
2: 5½″ x 11½″ 2 pcs.
3: 5½″ x 17½″ 7 pcs.
4: 11½″ x 11½″ 2 pcs.
5: 11½″ x 17½″ 4 pcs.



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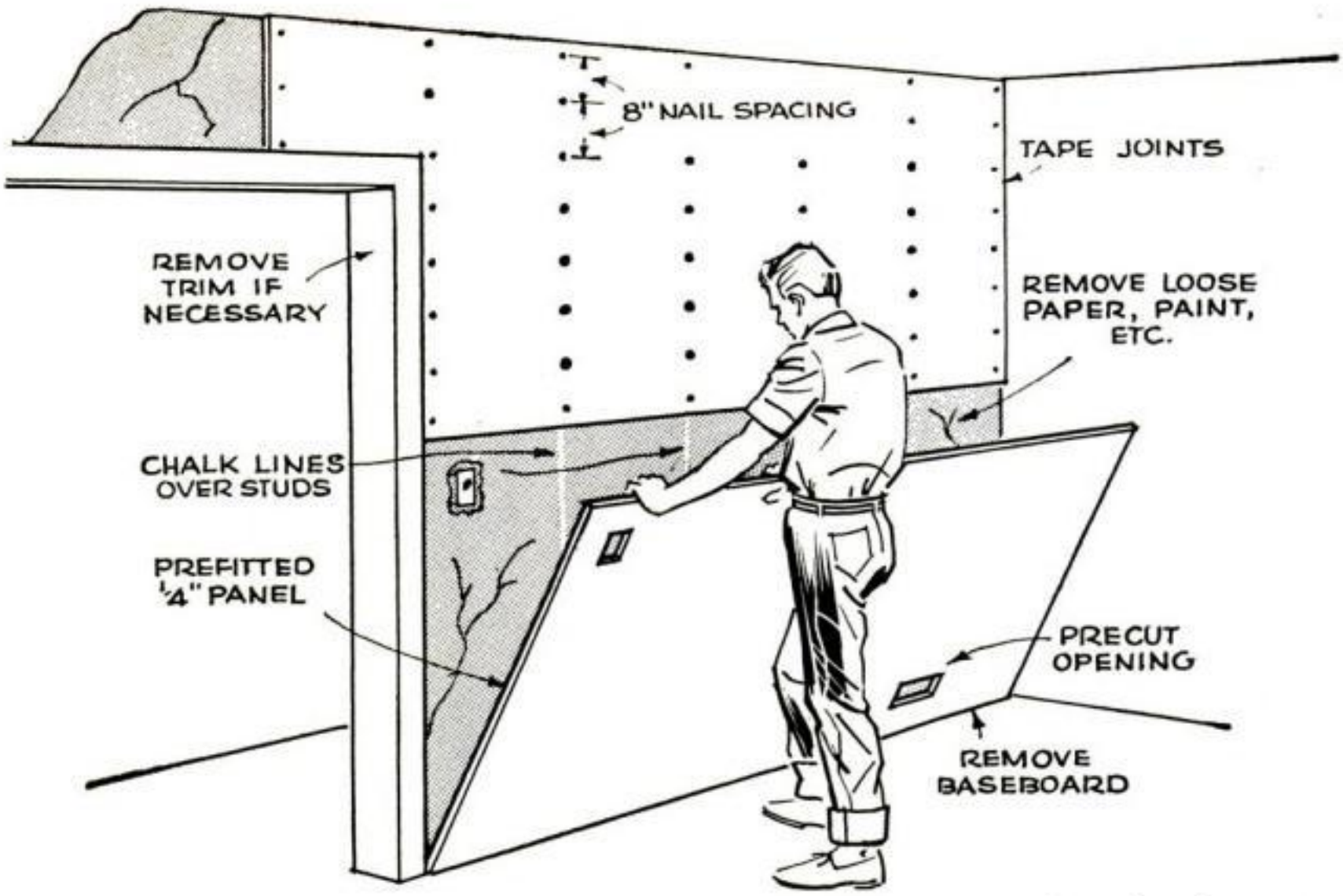
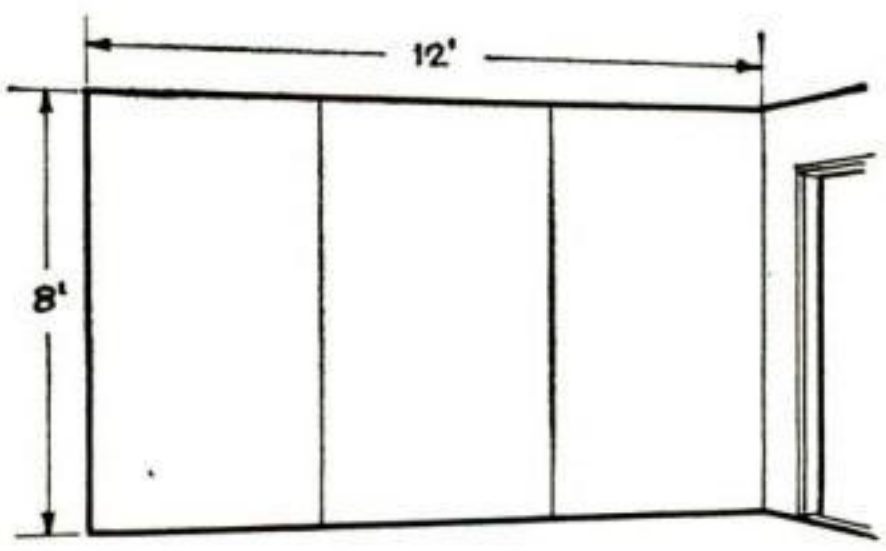


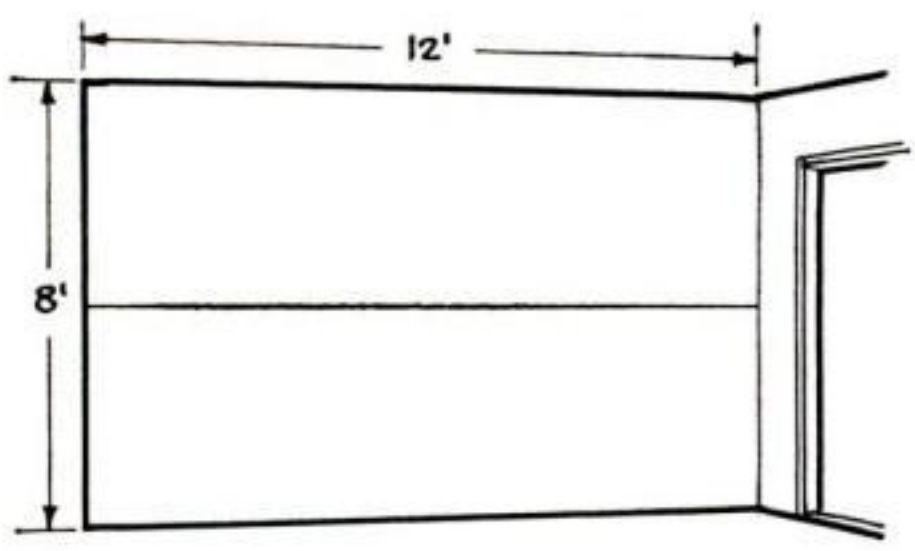
Save money by using ¼" plasterboard to re-cover walls that are sound but in poor repair. If walls are uneven, use furring strips horizontally on 16" centers and shim out or plane off strips to get an even backing. For a nailing guide, snap chalk line over stud locations.

Time-Proven Tips for

These tricks of the trade will make it easy for you to put up new walls and ceilings. You'll find them a big money-saver on do-it-yourself remodeling jobs

By Charles E. Rhine





Plan the job to use the largest-size panels you can fit on the walls and ceilings. The job will go faster and there'll be fewer joints to cover. Use scale drawing to plan layout. Panels come 4′ wide and 8′, 10′, 12′, and 14′ long. An 8′-by-12′ wall will take less work, obviously, if you use two 12′ panels horizontally, as shown above, rather than three 8′ panels vertically.

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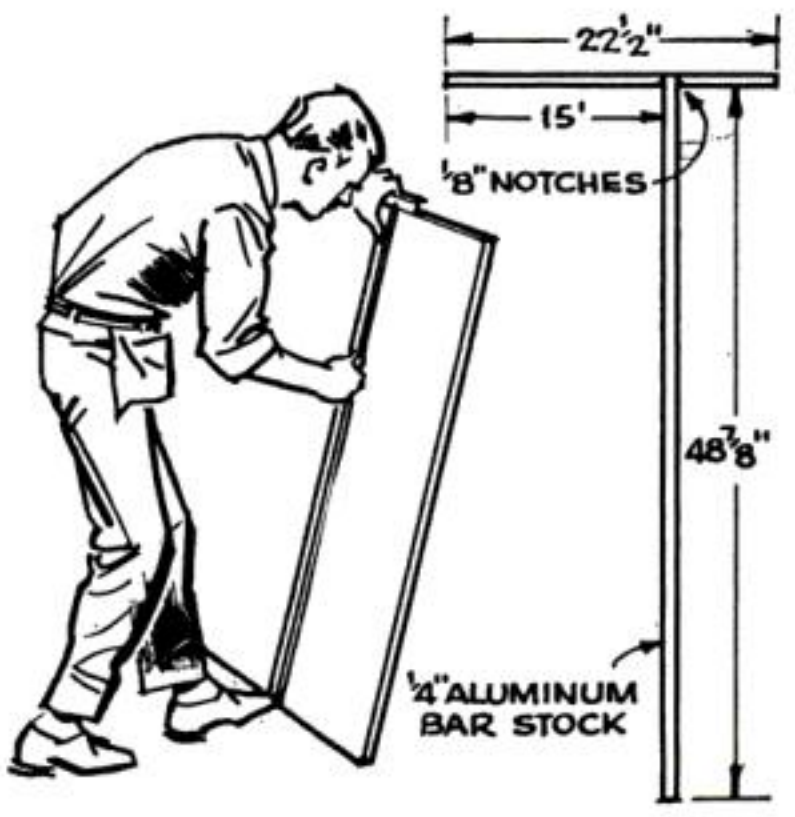
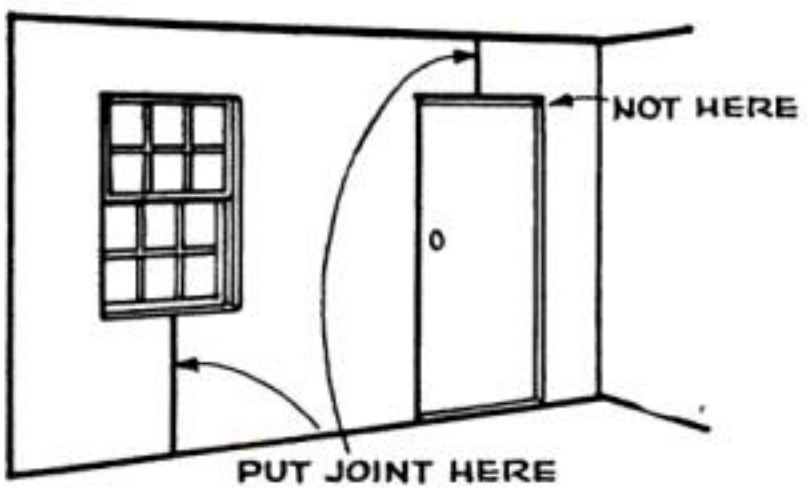
If quarters are cramped, don't cut an unwieldy panel just because you can't maneuver it. Score it on the back, then fold it forward for easier handling. Place fold line on a stud. Do this to turn one or more inside corners.



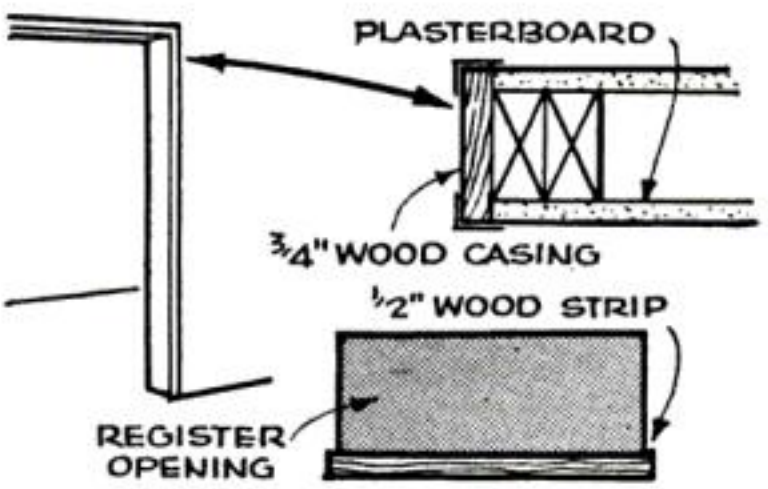
If a panel is not cut square, you'll get gaps at joints that are hard to fill in. Make a large T square from a piece of aluminum bar stock and use it to score panel across full width. (The knife would dig into a wooden T square.)

Installing Plasterboard



Locate joints under windows. Light is poor here and joints will be easier to hide. Put joints above doors, not at door corners. Constant door slamming will crack open corner joints.

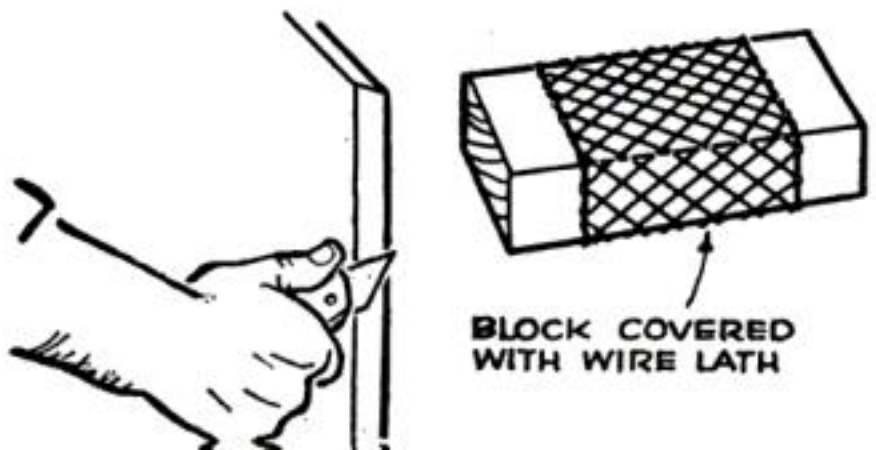
If the fit is tight, don't force the board into position. Trim the edge on a bevel, undercutting the back of the panel to help lock in joint cement. A block covered with wire lath is good for smoothing any roughly broken edges.



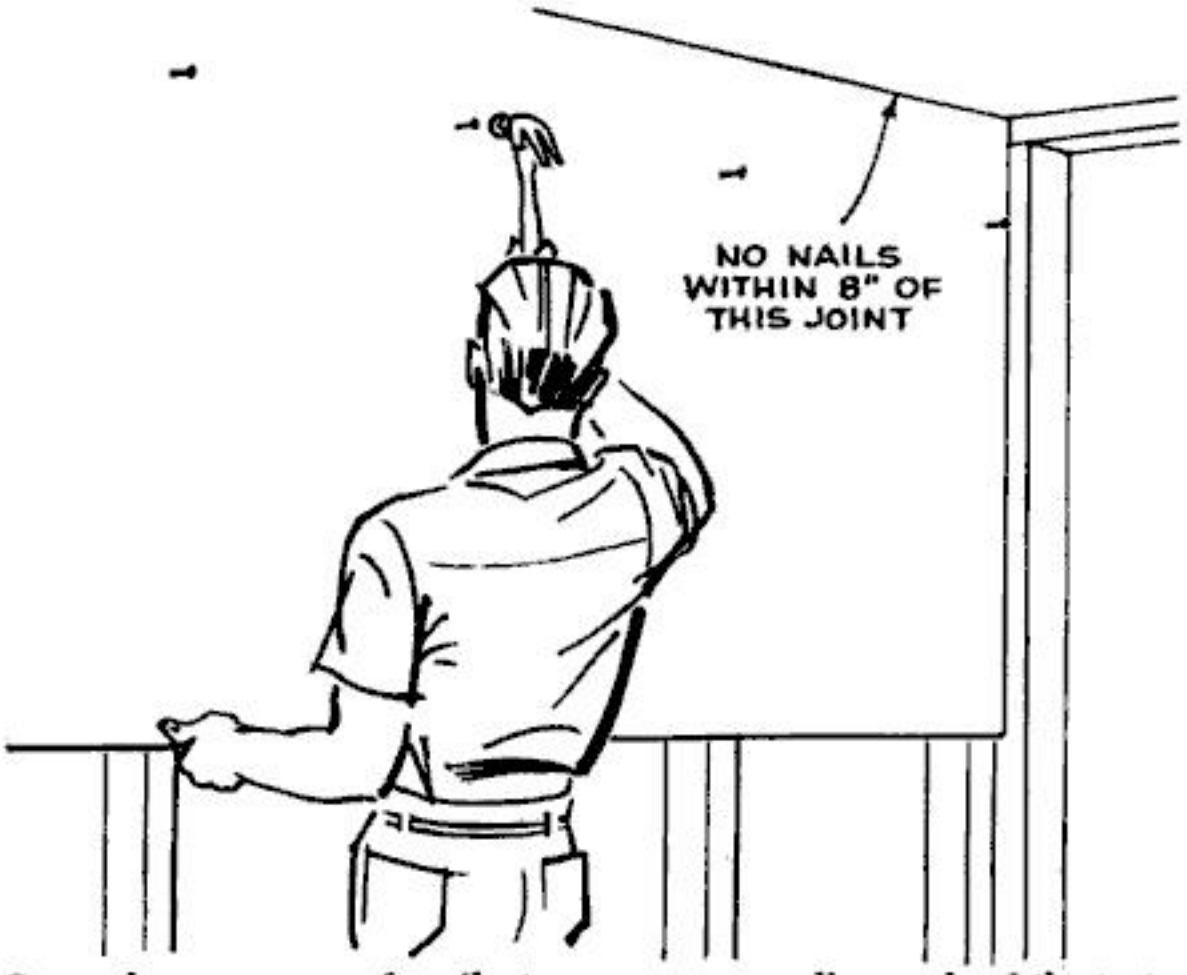
Use wood for narrow strips, of the kind you might need under a hot-air register or around an untrimmed wall opening. Primed, and painted, wood can't be told from plasterboard.

To make openings for ducts and electrical outlets, try this time-saver: Mark opening location, score front surface of plasterboard as shown. Then knock out pieces with a hammer blow and cut away the back paper.

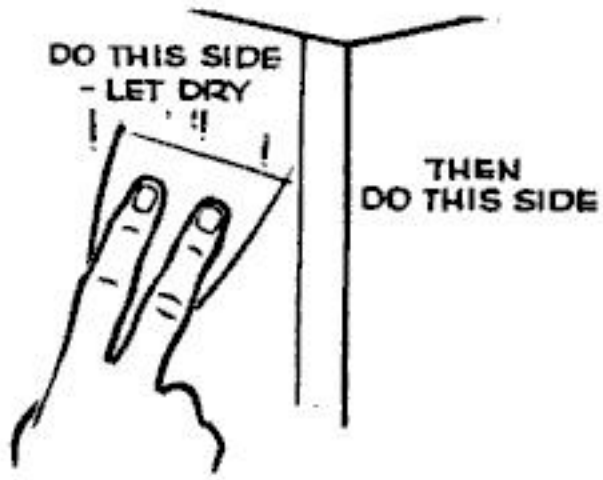
CONTINUED



Urheberrechtlich geschütztes Material

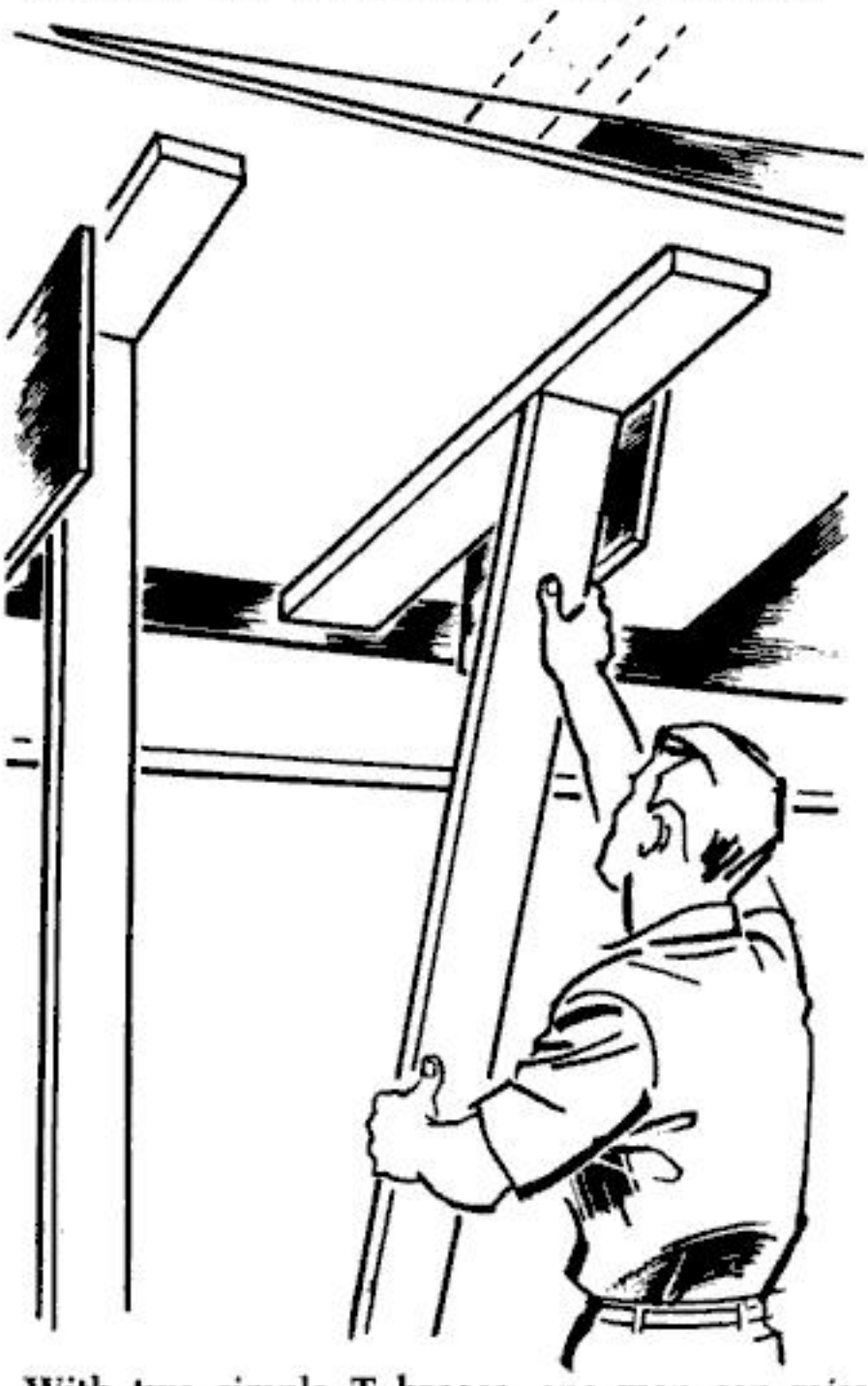


Start the top row of nails in an upper wall panel while it is resting on the floor. Then you can raise the panel and drive the nails home while holding the panel in position with the other hand. Eliminate stress cracks at ceiling joints by omitting nails any higher than 8" from the top.

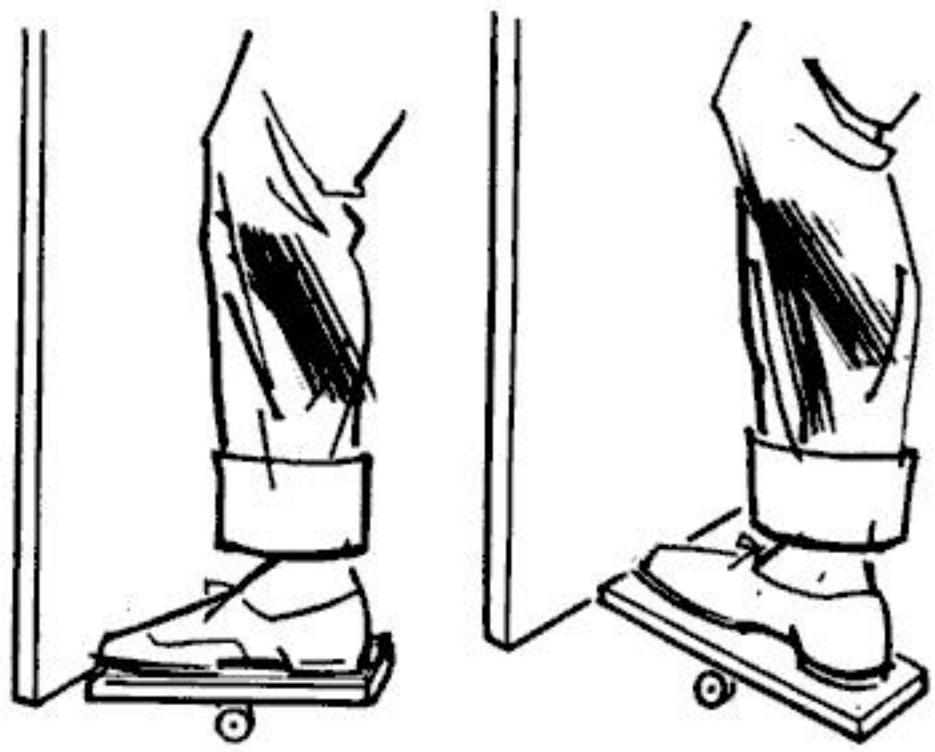


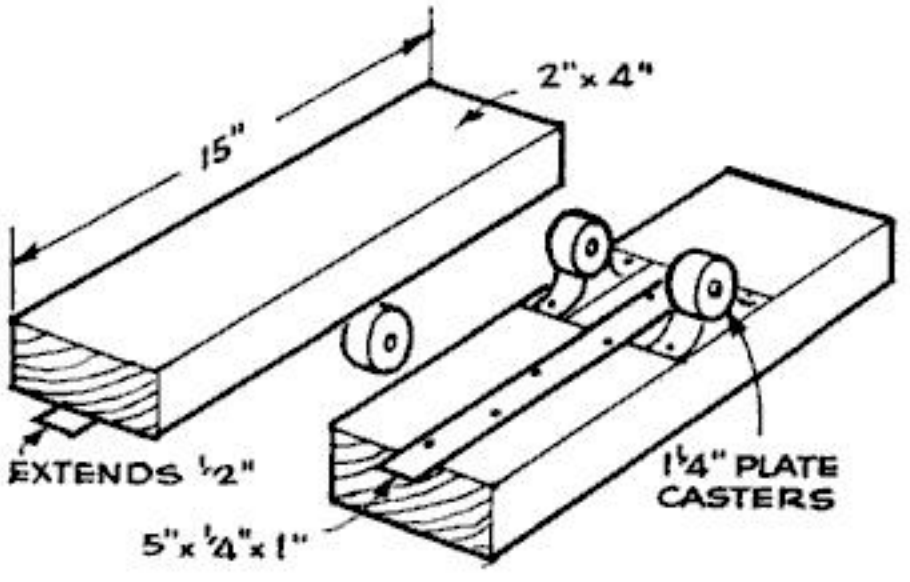
A smooth finish on both sides of an inside corner is hard to get sometimes. You get one side smooth, then mess it up while doing the other side. The secret: Finish one side first, let it dry, and then do the other side.

You can save a lot of finish sanding of uneven joints by smoothing the final coat of joint cement with a damp sponge. Let the cement stiffen a bit before sponging. Determine when it's right for smoothing by testing the cement from time to time.



With two simple T braces, one man can raise and hold ceiling panels. Make braces about 1" longer than ceiling height. Prop one brace under the edge of an existing panel to form a lip to hold one edge of the new panel while you use the other to raise the panel in place, as shown.





Make a plasterboard roller-lifter and you can lift panels as much as 3", move them in tight against the wall, and hold them snugly against the panel above while you nail. The lifter can be quickly assembled from a piece of 2"-by-4" scrap, a couple of casters, and a steel strip.

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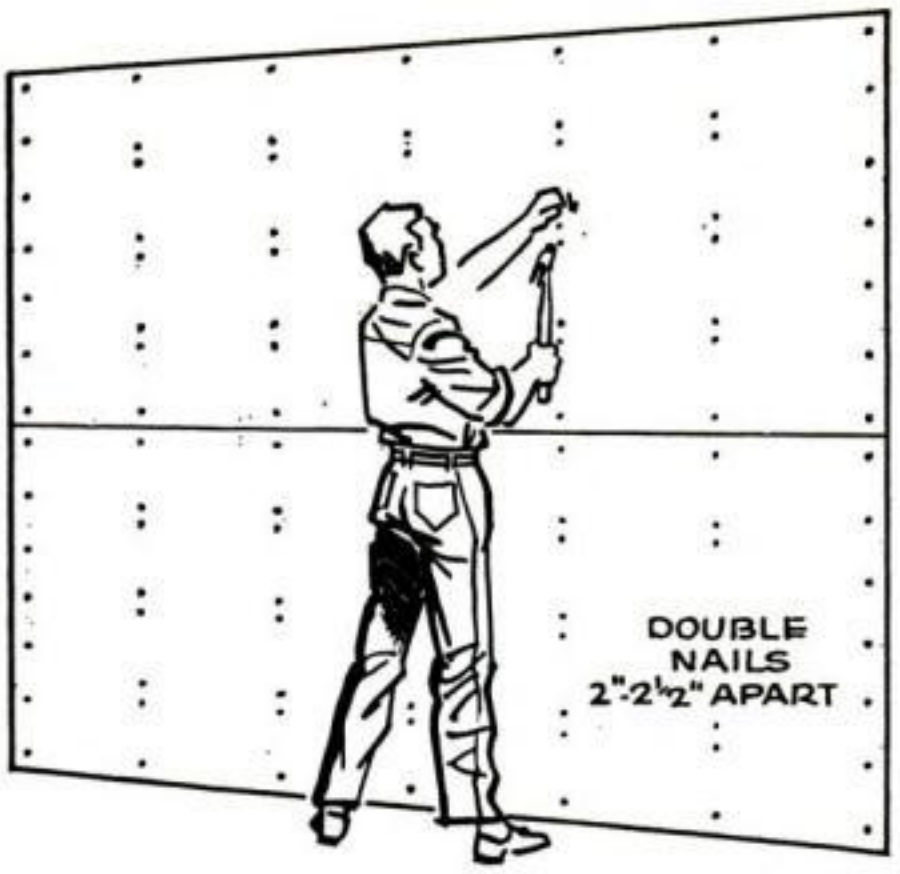
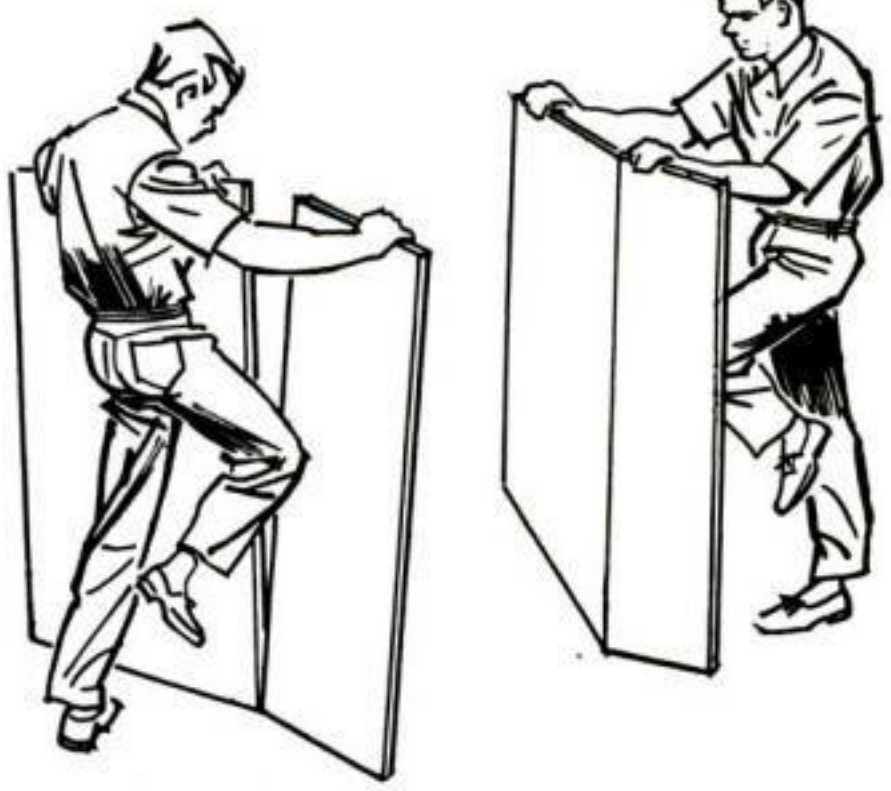
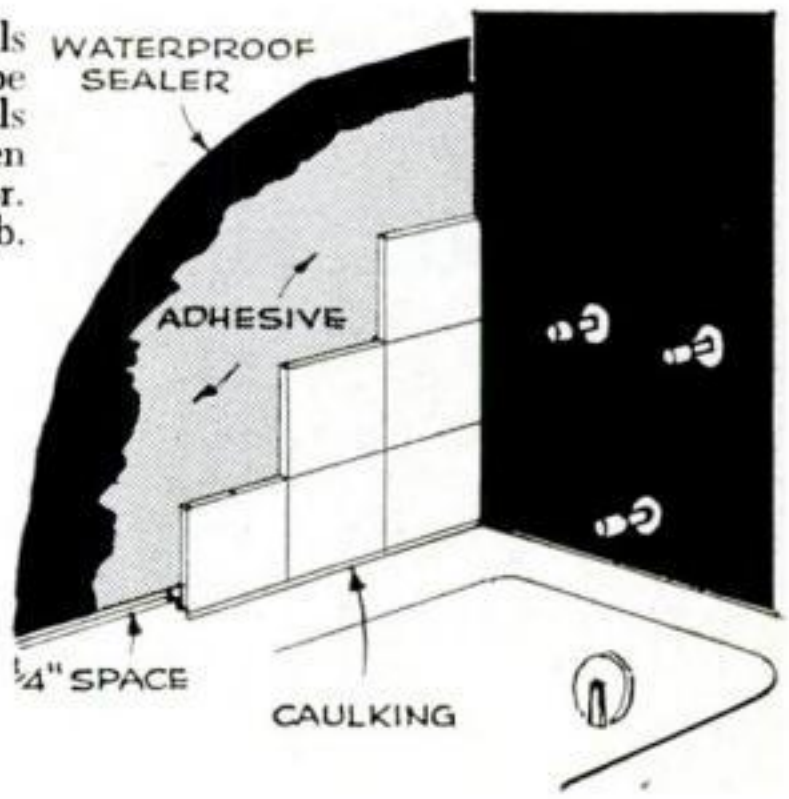


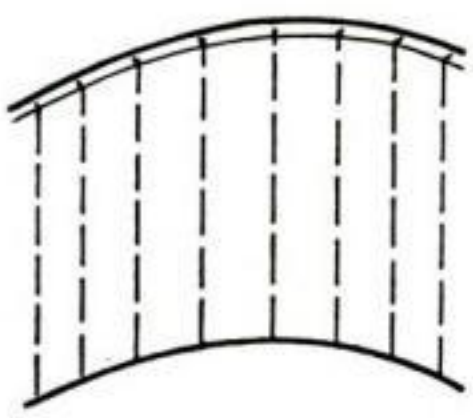
For a stronger job, drive five nails evenly spaced across panel width, then put a second nail 2" to 2½" from each of the middle three. The panel will pull up so much tighter that you may have to give the first ones an extra tap.



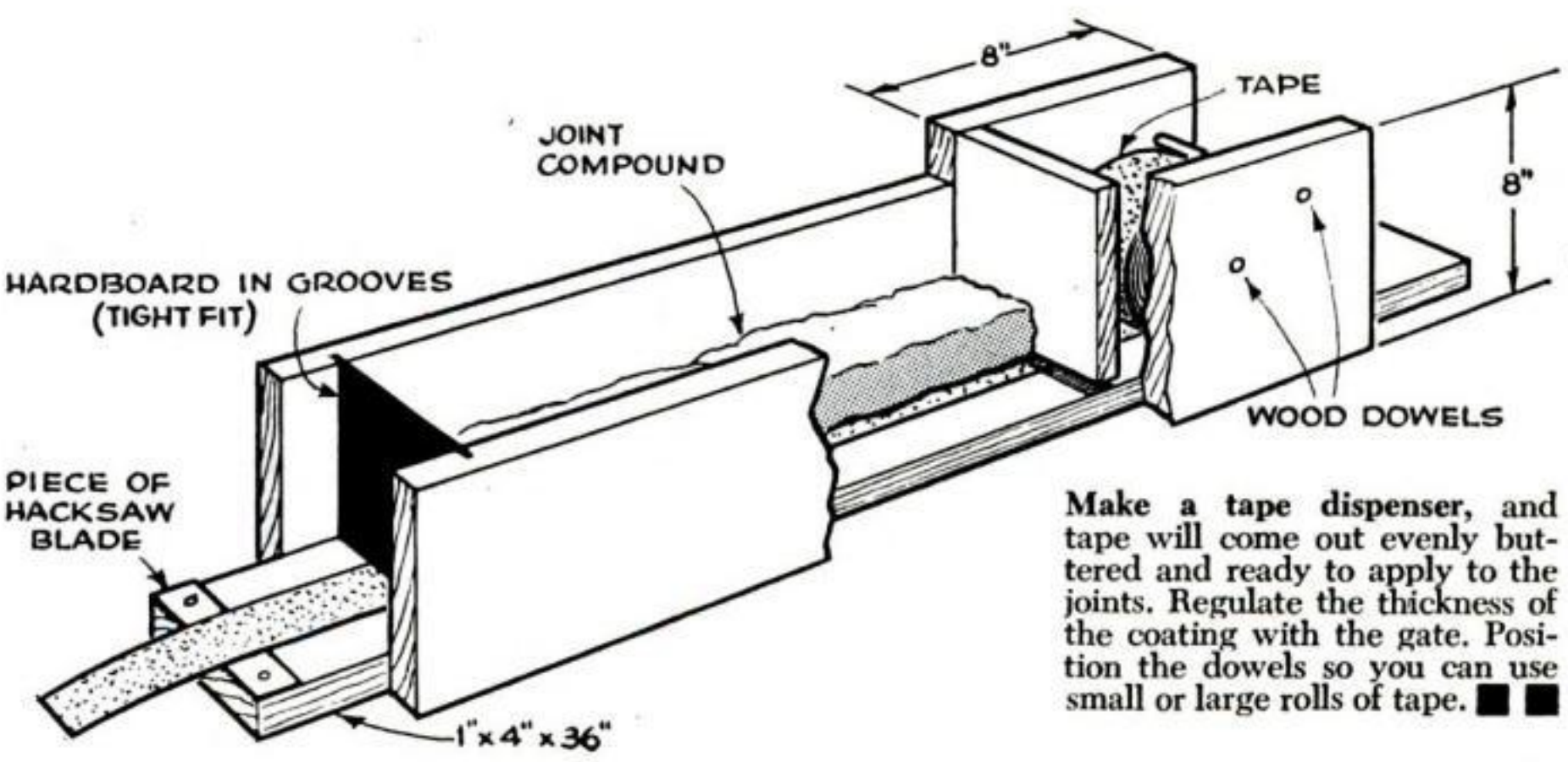
Not enough horizontal work space nearby to cut the panels? Then lean them against a wall and score a line on the face. Knee the back surface to snap the core, score the back paper, and knee the front to break it loose.

Put plasterboard around tubs (right) and in shower stalls as a base for ceramic, plastic, or metal tile that is to be applied with adhesive. The trick is to use full-size panels score-folded at the corners. Leave ¼" space between paper-bound edge of panel and tub or shower receptor. Treat with waterproof sealer, caulk around rim of tub.





Plasterboard will bend around moderately curved surfaces. But if the curvature is too great for the normal bend of the panel, you can make it conform by scoring the back paper every few inches and breaking the core beneath each panel cut.

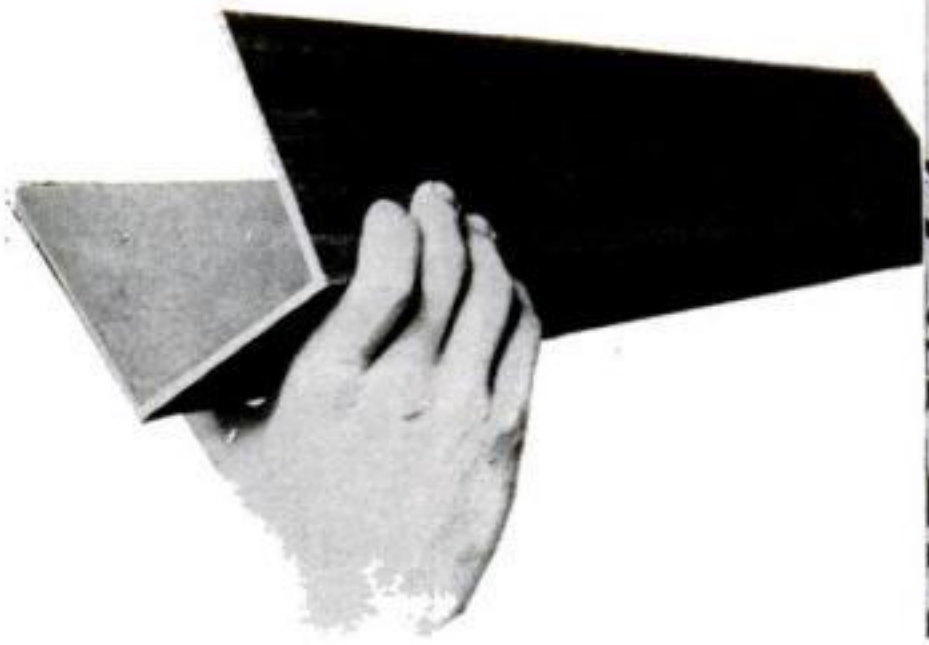


Make a tape dispenser, and tape will come out evenly buttered and ready to apply to the joints. Regulate the thickness of the coating with the gate. Position the dowels so you can use small or large rolls of tape. ■ ■

Urheberrechtlich geschütztes Material

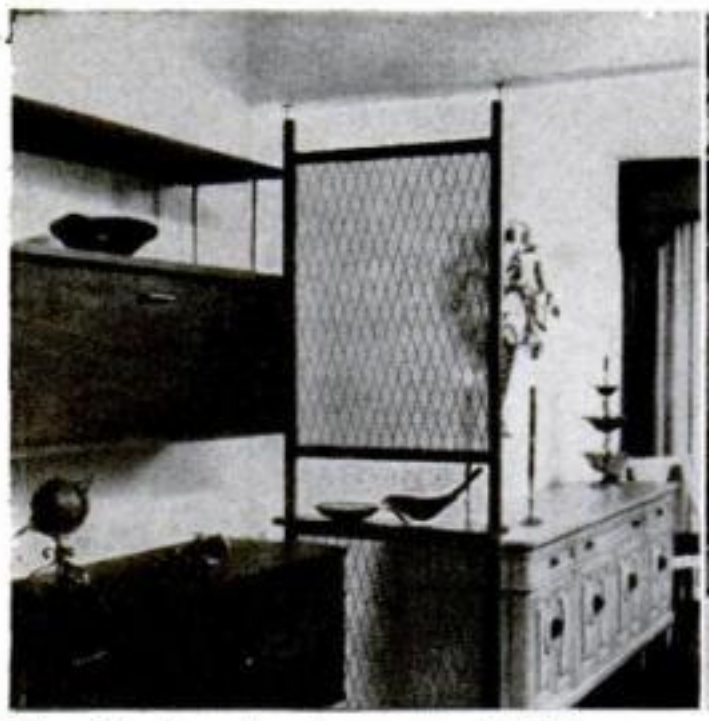
IMPROVE YOUR HOME

New Products for Improving Walls and Ceilings



Now You Can Fold Your Own Ceiling Beams

Vinyl-coated hollow hardboard beams look like wood, nail up easily over furring strips, and cover plasterboard joints. Flat Vinylfold strips fold to form U sections 2⅜" by 4". They come in 12', 14', or 16' lengths. Besides making a decorative ceiling, the wood-grain-patterned beams neatly conceal wiring. A product of the National Gypsum Co., the folding beams are sold by building suppliers.



Plastic-backed room dividers

Amber or olive translucent plastic that looks like stained glass backs these openwork room dividers with spring-loaded mounting legs. Panelboard Mfg. Co. sells several patterns through lumberyards.

Decorative paneling is rough-textured

A rough-sawn plywood paneling called Ruff-Cut has been announced by Pope & Talbot, Inc., Kalama, Wash. It comes in Douglas fir, cedar, and Philippine mahogany in five styles—board-and-batten, reverse board-and-batten (above), Texture 1-11, and regular and random V-grooving.

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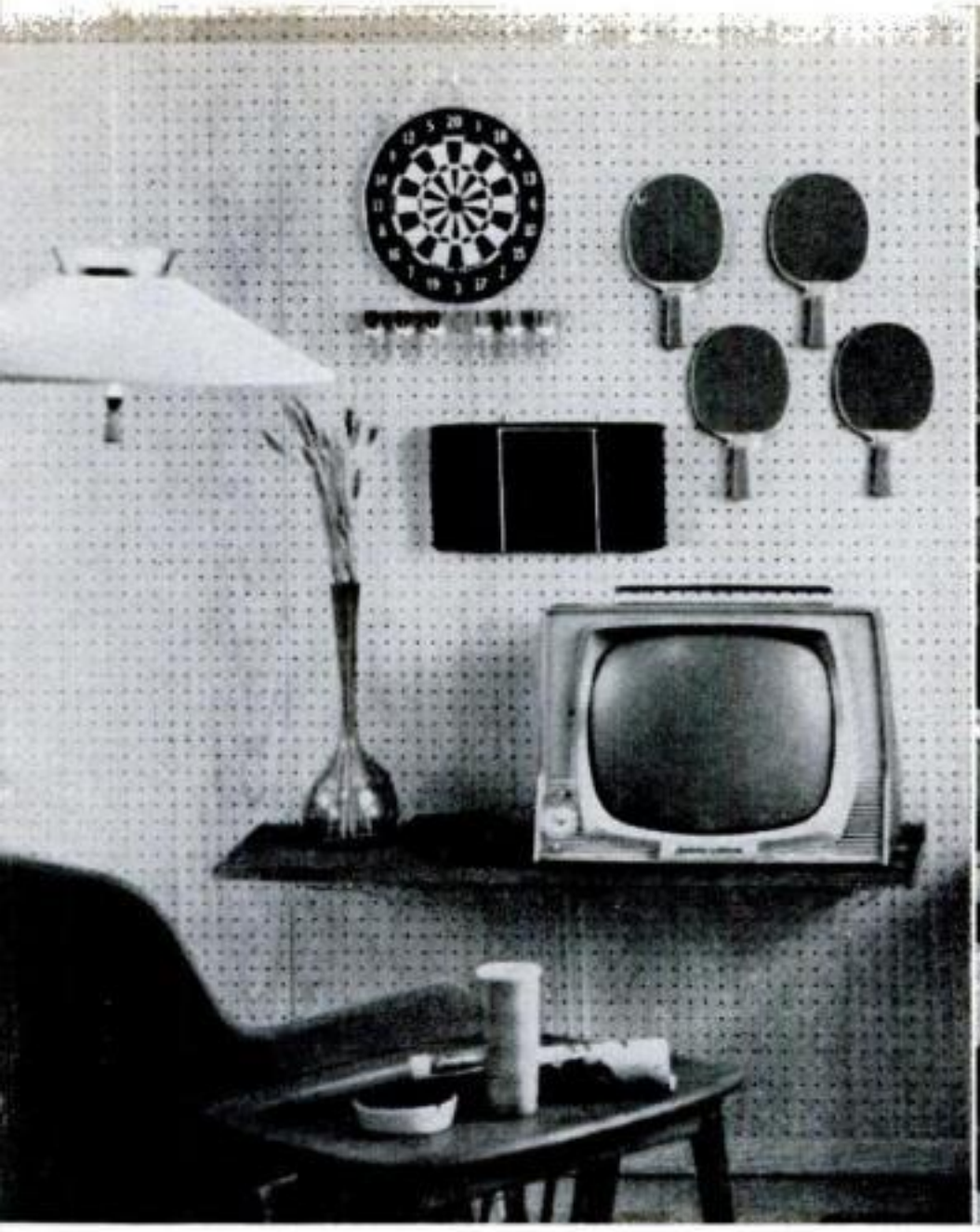
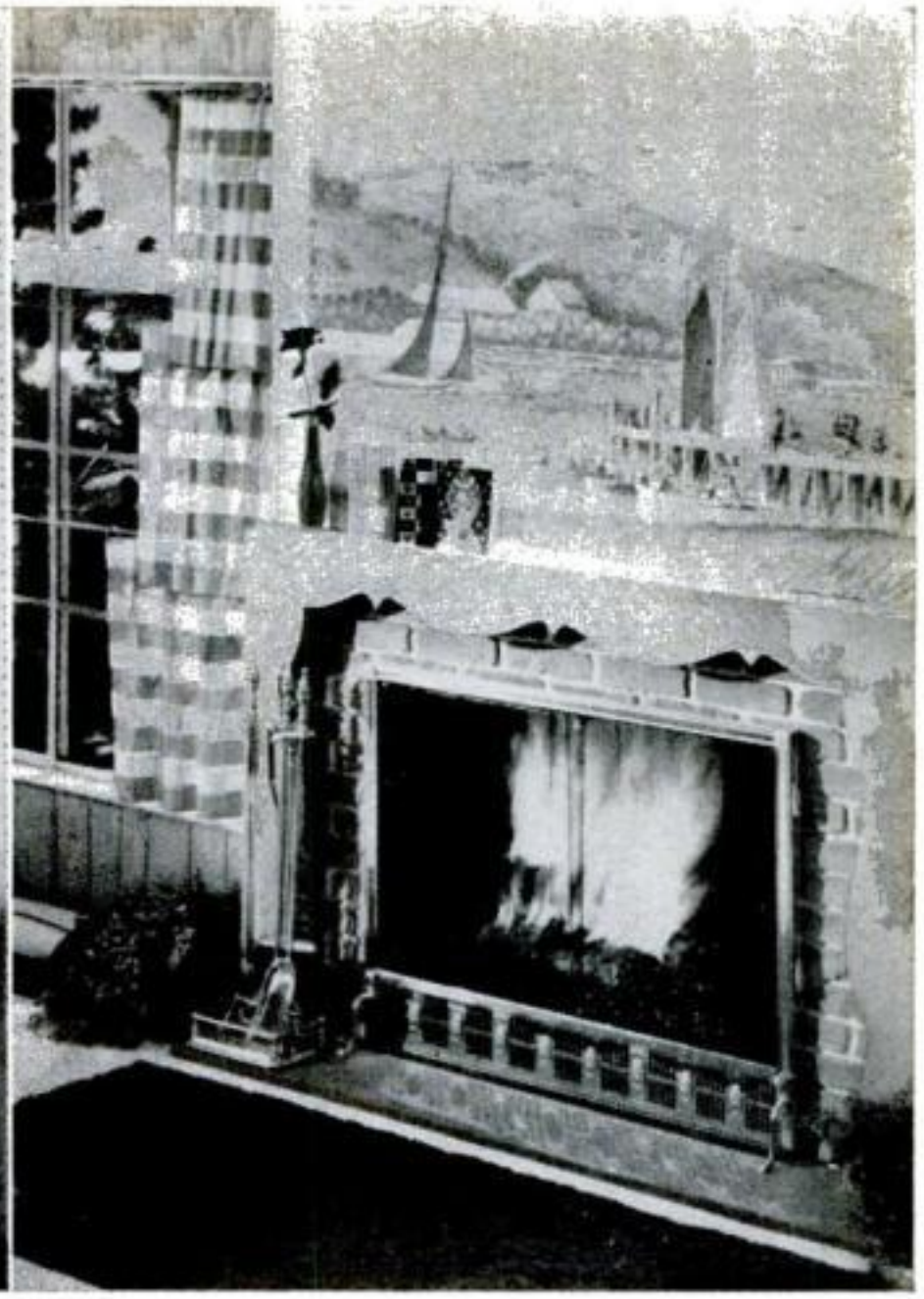


Perforated hardboard has texture finish

You can now buy perforated hardboard with a walnut finish applied at the factory. Masonite's new Royalcote Walnut Peg-Board comes in three tones to match their wall paneling. Matching colored nails also are available for installing the panels.



Murals decorate prefinished panels

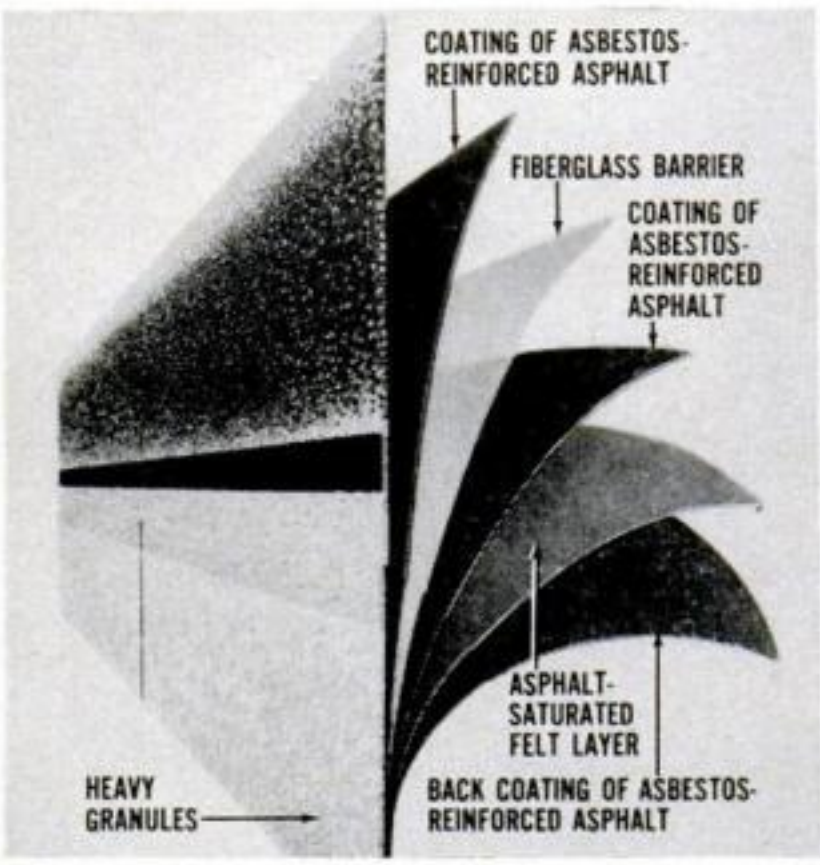
Wet or dry walls for any room can now be refinished with murals or wood-grain panels. Gold-on-white murals are on 5′-by-5′ or 5′-by-6′ panels. Marlite Panels, made by Marsh Wall Products, Dover, Ohio, are sold by building-materials suppliers.

Flexible radiant-heat panels on ceilings warm rooms fast

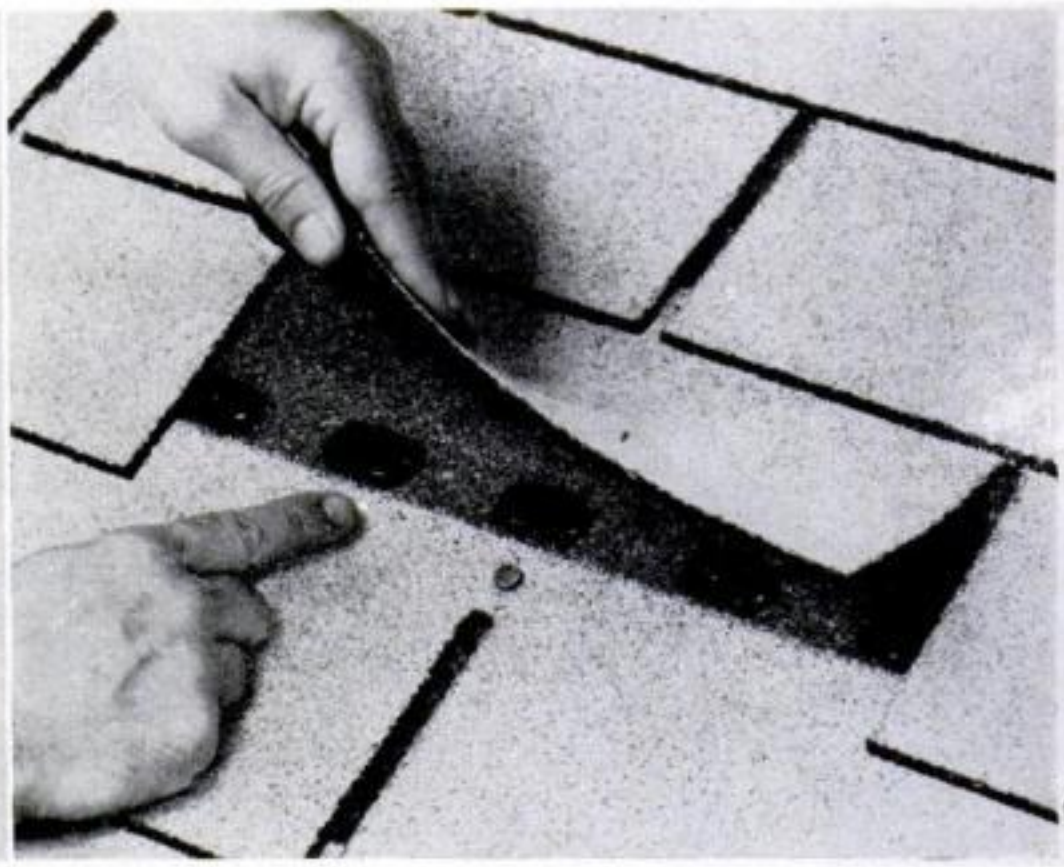
These pliable panels go up like wallpaper (left) to provide automatically controlled radiant heat for added rooms. Resistance wires woven into knitted nylon (far right) are sandwiched between vinyl sheets. House current reaches each panel through a hole in the ceiling. Matching unwired panels fill in where no heat is required and can be stenciled (center) with decorative patterns. Sun-Glo is a byproduct of aircraft de-icing equipment made by Goodyear's Aviation Products Div., Akron, Ohio.

Urheberrechtlich geschütztes Material

NEW ROOFING:



Top rating in fire protection has been won from the Underwriters Labs by special asphalt shingles made by several companies. This is Johns-Manville's new Seal-O-Matic.



Spots of thermoplastic adhesive are factory-applied on thick-butt asphalt shingles made by Bird & Son. Sun's heat sets the adhesive, making the shingles resistant to wind.

By John Ingersoll

YOU don't put a roof on your house very often, and when you do it's worth a little thought. You might want to use the new poly-iso-butylene material that is so rugged you need only a single layer—so flexible and elastic it can be used on some of those modern turtleback buildings. On the other hand, you might want to re-roof with classic shakes that suit the dignity of your traditional-style house.

Either way—or in between—there are many new materials and new ideas in roofing that you'll want to know about.

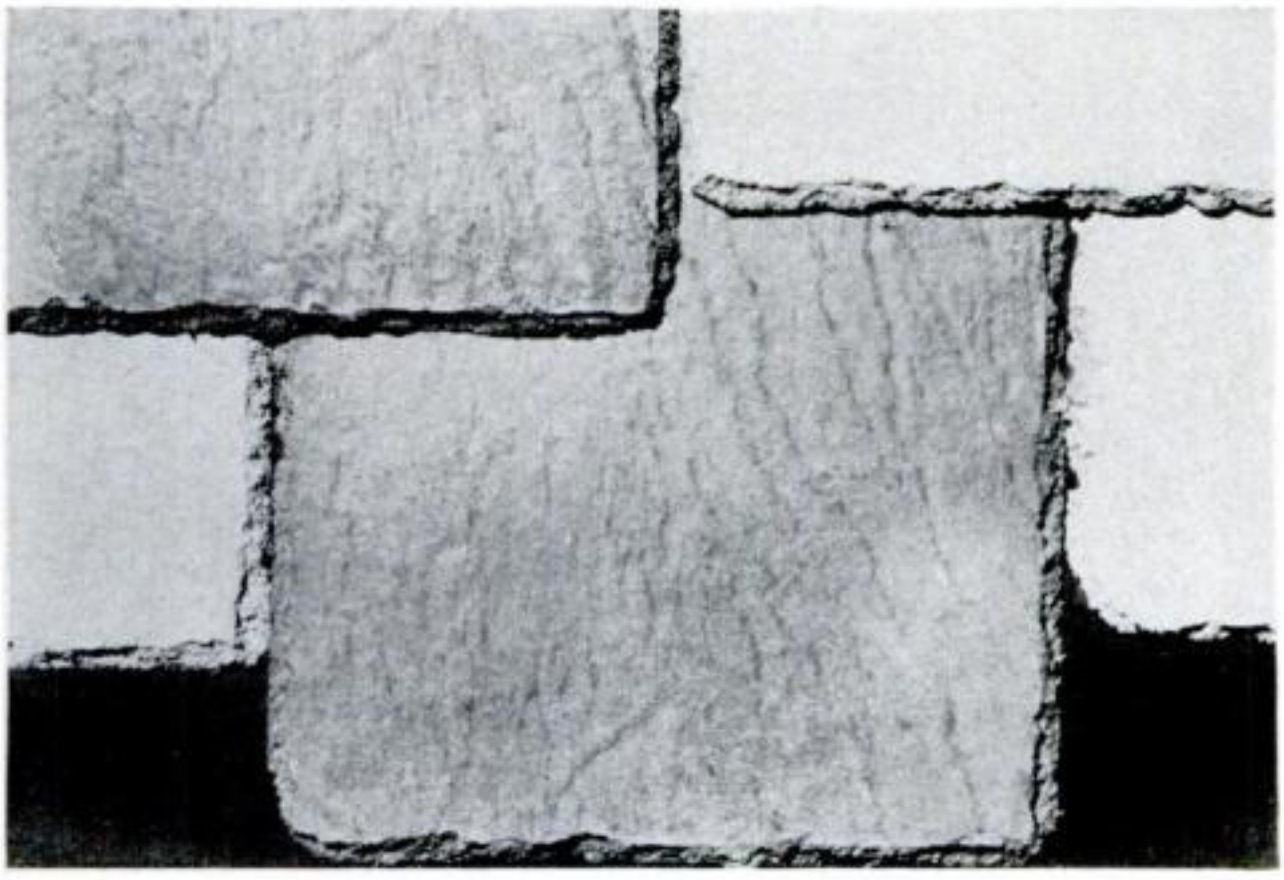
Asphalt shingles. There is now a big, tougher, 325-pound asphalt shingle (325 pounds per 100 square feet installed) that is rated "A" by Underwriters Laboratories. This means there is little chance a fire would ever start in your roof *from the outside.*

Until recently, asphalt shingles rated only Class C. Two companies (Johns-Manville and Ruberoid) protect their 325-pounder with an inner layer of fiberglass. Two more (Barrett and Philip Carey) produce the Class A shingle with a protective layer of asbestos-reinforced sheet.

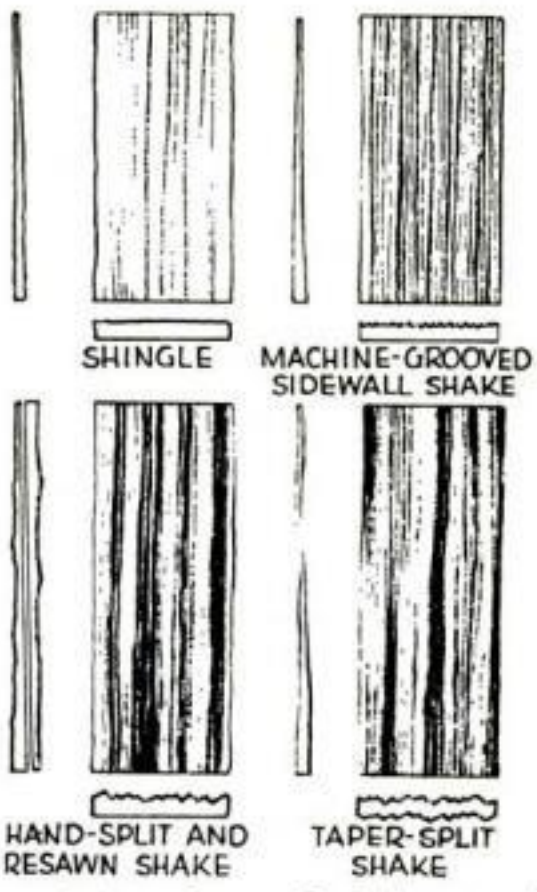
You'll pay more than $30 for each 100 sq. ft. installed for the new shingles. But, in addition to the Class A rating, the new shingles should outlast lightweights by 10 years, and they will stay down better in a windstorm. The trend now is toward heavier shingles. This began in 1963, when FHA raised its minimum standards for asphalt shingles from 210 to 235 pounds.

The extra weight licks the deteriora-

Better Than Ever



Slatelike texture and jagged edges give these new roofing shingles by Johns-Manville a quarried rather than manufactured look. They're actually made of mineral fiber. They can be bought in six different color tones.



Wood shingles and shakes tend to be a bit cheaper now because manufacturing improvements have trimmed production costs.

IMPROVE YOUR HOME

tion problem. The wind problem is cured by seal-down shingles, most of which have factory-applied patches of adhesive that keep the flaps from lifting. Once the roof is down, the sun's warmth softens the cement patches and seals each tab to the course below.

Shingles go down faster, too. The 36″-long "strip" asphalt shingle has practically taken over. Most strip shingles have three tabs, but some have only two. At least one maker (Bird & Son) produces a solid strip with indentations instead of cutouts to mark the tabs.

Clay tile. The popular styles are now ribbed underneath to lower the weight and reduce the cost slightly.

Mineral-fiber shingles. This is the new name for asbestos-cement shingles. The most prominent change comes from Johns-Manville. The company has turned out a shingle with an amazing resemblance to slate. It's heavy, tipping the scales at about 540 pounds per 100 sq. ft. At ¼″ thick, it's more resistant to breakage.

What's ahead? Johns-Manville's new poly-iso-butylene comes in rolls, like standard roll roofing, but it is a far more weather-resistant material. Long used in Germany, it has undergone tests that promise more than 30 years' service.

Other plastics for roofing are vinyls and similar materials which may be molded in the form of regular roofing materials—or which may be sprayed or rolled right on the roof.

A chart on the following two pages summarizes all types of roofing.

Urheberrechtlich geschütztes Material

HOME OWNER'S GUIDE TO

TYPE	WHAT IS IT?	SIZE	WEIGHT (pounds per 100 sq. ft.)	APPEARANCE	FIRE RATING*
ALUMINUM SHINGLES	The same aluminum used for siding, with or without baked enamel colors. Nearly all shingles interlock	Normal size is 12" x 36", but some shingles come as small as 12" x 18"	About 50	Most have a striated surface in a slightly irregular pattern. Colors: natural aluminum, green, gray, blue, beige, red, white	No fire rating. One shingle has pending Class C approval. Most fire experts consider the metal adequate in a fire that isn't severe
ASPHALT SHINGLES	Roofing felt, saturated with one kind of asphalt and coated with a second kind, with a surface of mineral granules. Types rated Class A have a layer of either asbestos or fiberglass	Most common size is 12" x 36", with 1, 2, or 3 tabs and square butts. A few lock-down or lock-tab shingles in a 2-tab strip 18" x 24" are available. Others are 16" x 16" to 20" x 20"	235 to 325 for the most commonly used square-butt, strip shingles. From 180 to 235 for other types	Black, white, and gray are the top sellers; also comes in greens, reds, browns, blues. Heavyweights have a thicker butt which makes a distinct shadow line on the roof. Surface is granulated	Nearly all the lightweight shingles carry a Class C rating. One company makes a Class B shingle, and four firms produce a 325-pounder with a Class A rating
BUILT-UP ROOFING	Separate layers of asphalt-saturated felts, applied one at a time, and mopped to the roofing deck with hot asphalt or hot pitch. Gravel is generally spread over the final layer of hot asphaltic material	Finished roof is one piece	Depending on number of plies, from 470 to 600	Color comes from the gravel spread over the top. Natural stones in white, black, gray, blue, red, brown	If the roof has three or more plies, one of which is a 30-lb. dry sheet, UL gives the roof a Class A rating. Otherwise, no rating is given, although all are somewhat fire-resistant
CLAY TILE	Produced from high-quality shale clays baked in high-temperature ovens. Ceramic colors are burned into the surface	Most commonly used shingles vary from an exposure size of 7" x 6" to 8¼" x 11"	800 to 1,750	Striated shingles resemble wood. Some are smooth-surfaced. In blacks, whites, natural slate grays and buffs, reds, yellows, greens, blues	Barrel tiles and shingles that interlock have a Class A rating. None will burn
CONCRETE	Tiles are made of high-strength concrete, reinforced with steel wire and coated with paint. Poured-in-place "Bermuda" roofs are produced with lightweight perlite or vermiculite concretes, and also require painting	Tile is generally from 6" to 8" wide and about 18" long. Poured concrete resembles heavy-butt shingles with a 19" exposure and a 2" butt	Tile weighs about 1,200. Poured-in-place, perlite or vermiculite concrete is 450 to 500	Many tiles look like wood shingles or shakes. Others are smooth-surfaced. Colors: wood tones, white, pastels, dark green, red	Neither tile nor poured roofing has an official fire rating from UL. But both products are incombustible
COPPER	It's sheet copper, untreated	Forms a one-piece roof, although seams give it a variety of appearances	20-oz. copper weighs 125; 16-oz., 100; 10-oz., 62½	Sheet develops a green patina. Can have flat or standing seams, or seams that are bent over battens	Copper has no official rating, but it is definitely fire-resistant
MINERAL-FIBER SHINGLES	A shingle made of Portland cement, reinforced with asbestos fibers. Colors are impregnated during production. Often coated with a plastic as a final step	From 12" x 24" to 14" x 30", approximately 5/32" thick. Others, including new slate-like shingles, run from 8" x 16" to 9" x 18". Newer shingles are ¼" thick	About 235 to 585	A new shingle has the colors and texture of slate. Standard product is striated to resemble wood shakes. All available in black, white, gray, red, brown, green	Class A, provided the shingles are installed on a roof no flatter than 4" in 12", which has an asbestos felt underlayment over the deck. Otherwise, Class B
SLATE	Cut from natural, mined slate	From 12" x 6" to 24" x 14"	700 to 800	Both smooth- and rough-textured shingles are cut. Available in all natural slate colors: black, gray, green, purple, red	Has no official fire rating, but it won't burn
TERNE METAL	A copper-bearing sheet steel, coated with 80-percent lead and 20-percent tin. It must be painted. Roofers sometimes call it tin roofing	Forms a one-piece roof, although seams give it a variety of appearances	About 70	Since terne metal has to be painted, it can be any color of the rainbow. Sheets are smooth-surfaced; appearance depends on seam design	No official fire rating, but it's definitely fire-resistant
WOOD SHINGLES AND SHAKES	Just about all U.S. production of wood shingles comes from western red cedar. Some is delivered untreated, but it's available now prestained or presealed	Shingles are of random width, from about 6" to 8", and are cut in three lengths: 16", 18", and 25". Thickness at the butt ranges from ⅜" to 1¼"	200 to 300	There are three styles: a smooth-surfaced, machine-cut shingle; a thinly tapered shake; and a thick-butt, hand-split, and resawn shake. Natural reddish-brown color will weather to soft gray, or the wood can be stained	No fire rating, and they are not fire-resistant. However, research continues to find a chemical impregnation that will make them fire-resistant
ROLL ROOFING	Same ingredients as asphalt shingles, but it comes in long rolls and is lighter than asphalt shingles	Rolls are from 18" to 36" wide, from 36' to 76' long. Exposure sizes vary from 8" to 34"	Average is about 120. Full range includes a low of 45 and a high of 188	Rolls with mineral granules include black, gray, white, most of the popular pastel colors. Some are embossed to resemble wood; others have patterned edges	Class C, when put down according to UL specifications

*Underwriters Laboratories rates fire resistance of roofing materials as follows: Class A: a product that is effective against a "severe" fire-spread hazard. Class B: shingles that resist a "moderate" fire-spread hazard. Class C: material

Urheberrechtlich geschütztes Material

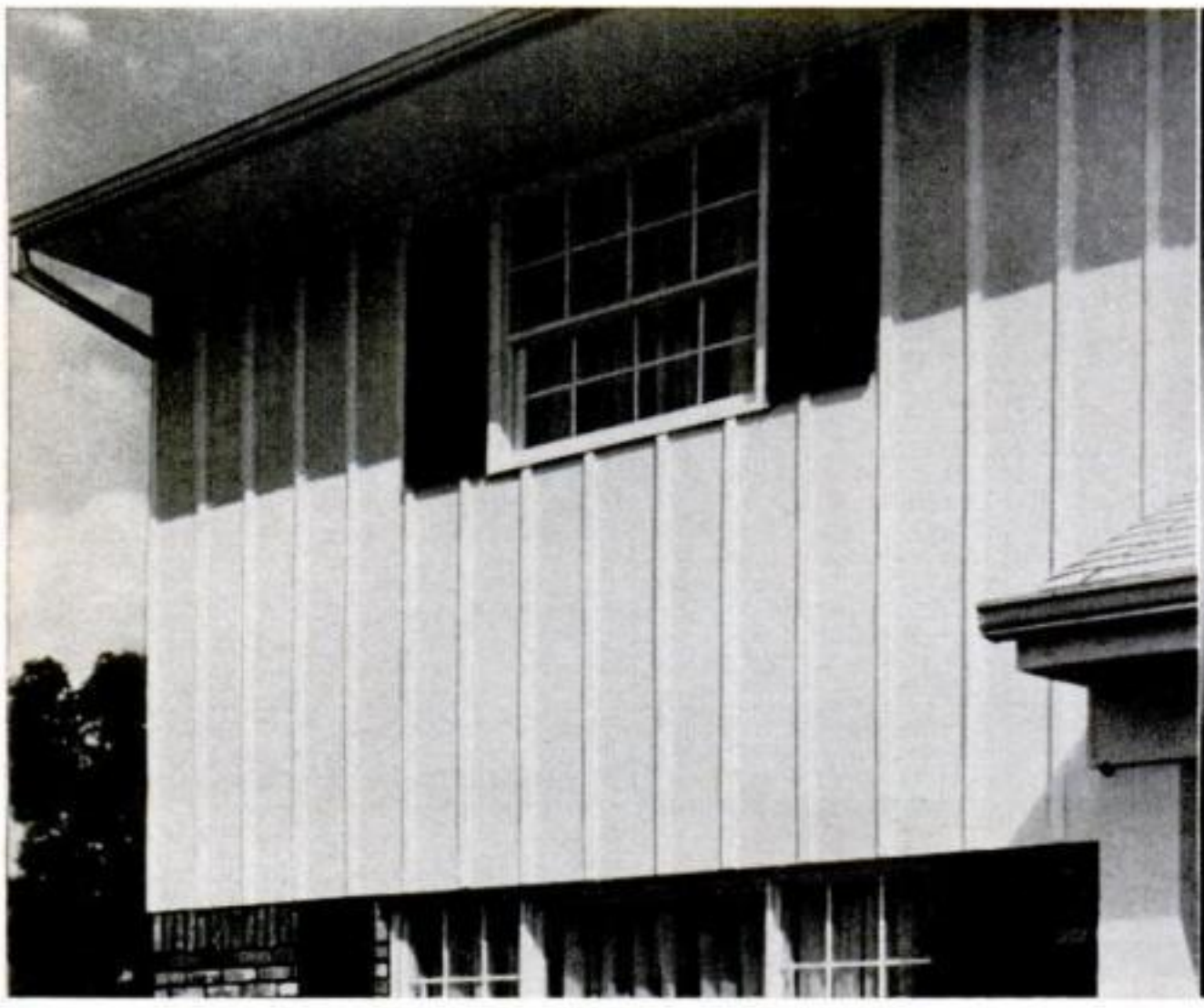
ROOFING MATERIALS

MINIMUM ROOF PITCH	HOW LONG WILL IT LAST?	PROBLEMS RE-ROOFING WITH IT	SPECIAL ADVANTAGES	APPROXIMATE INSTALLED COST (per 100 sq. ft.)
3″ in 12″, or 2″ in 12″ if the deck is covered first with a hot-mopped 15-lb. felt underlayment	Up to 35 years. But, if shingles come into contact with copper, lead, steel, or treated wood, failure could occur in 24 to 36 months	Can be applied over old asphalt shingles, or thin wood shingles covered with roofing felt. Otherwise, the old roof must be removed. Shouldn't go over more than two previous roofings	Holds up especially well in hot climates. Surface is a good reflector of sun heat, especially when the aluminum is uncoated. Shingles are interlocked, highly wind-resistant	$60 to $115
4″ in 12″ normally, or 2″ in 12″ if shingles are sealed or locked down. In high wind zones (Atlantic and Gulf Coast) FHA now insists that all tabs be cemented to deck	Materials in a 235-lb. shingle are now guaranteed for 15 years; over 300 lb., 25. Class A may last longer. All asphalt shingles have shortened life in the heat from Tampa, Fla., south	Bumps on the old roof must be flattened. Otherwise, asphalt shingles can be laid over any nailable surface, but not over more than one previous roofing	Most readily available of all roofing materials. Can be applied fast, repaired easily. When sealed or locked down, they are windproof	$19 to $36
Can be laid over a dead-level roof; should not be applied to a roof with a slope higher than 3″ in 12″	A 4- or 5-ply roof that is graveled in should last 20 years. A 2-ply roof without gravel may need repairs after 6 or 7	When it's applied over an existing built-up roof, the gravel and top course must be stripped off. In any other case, the old covering must be removed and the deck cleaned. Should re-roof only once over an old built-up roof	Finished roof is virtually windproof. With white marble chips graveled in, the roof is a good reflector of sun heat. Very easy to repair	$25 to $45, depending on the number of plies and topping
4″ in 12″	Tiles should outlast the house. Occasional repairs are required if a heavy limb falls and cracks a tile	Old roof covering must be removed. To install some of the heavier tiles, it may be necessary to shore up the roof framing	Baked-in colors last longer than colors on most other materials. Applied properly, the shingles are windproof. High-glazed tiles combat fungus growth	$100 to $180
4″ in 12″ for concrete tiles. Poured-in-place concrete can go over a flat roof, should not be applied on a slant much over 4″ in 12″	Concrete tile should last the life of the house. Poured-in place material, applied correctly and periodically repainted, should last as long as the tile	Old roof coating must be removed in most cases	Both tiles and poured-in-place concrete are, for all practical purposes, windproof. Good thermal—as well as reflective—insulator	Tiles from $60 to $85; poured, lightweight concrete from $40 to $60, including built-up roof below pour
With a soldered, flat-locked seam, copper can be laid over a ¼″ in 12″ slope	Copper 16 oz. or heavier should last at least 75 years. In a polluted atmosphere, copper could begin to go in 30 years	Old roofing must be removed	Copper stands up well in any weather—from Alaska to Hawaii. If applied properly, a hurricane won't lift it from the roof	$125 to $175
3″ in 12″	Material in the shingles should outlast the house. But individual shingles crack or break occasionally from such things as a falling limb	In many cases, the old roofing can stay. If mineral-fiber shingles top 500 lb., the old roofing may have to come up to reduce stress on the framing. In all cases, the roof surface must be smooth and flat. Should only re-roof once	Better application techniques and heavier shingles have cut down the possibility of breakage. Highly resistant to alkalis and acids in the atmosphere, as well as to salt spray	$35 to $75 for new work; up to $110 for re-roofing
4″ in 12″	Top grades of slate should last 75 to 100 years. Second grades and "ribbon" slate may need a close inspection after 30 years	Old roofing must be removed	Shingles are highly wind-resistant, weather beautifully in any climate	$60 to $100. Prices lean to the high side on the West Coast
With a soldered, flat-locked seam, terne can be laid on a ¼″ in 12″ slope	If periodically repainted, will outlast the house. It will need repainting about once every 8 to 10 years	Old roofing must be removed	Sheds snow and ice easily and is unaffected by heat, salt air, other corrosives. Though light, terne will stay down in hurricane-strength winds	$50 to $80, including first coat of paint
Best results when slope is between 4″ and 6″ in 12″	Shingles should last 20 years; longer if restained when needed. Shakes have protected roofs for over 50 years in some cases	An old roof in poor condition should be removed. Otherwise, shingles can be laid over any nailable surface, but not over more than one previous roofing	Wood is one of nature's best thermal insulators. Wood shingles can be repaired easily	Shingles: $25 to $45; shakes: $35 to $65
2″ in 12″. But so-called 19″-selvage, double-coverage roll roofing can be laid on a 1″ in 12″ slope if two sheets of 15-lb. felt are laid down first	From 5 to 10 years, but it may need spot repairs before 5	Can be applied over any nailable, flat surface. Should not be put down over more than two previous roofings	Goes down fast; is a good low-cost covering for tool sheds and other outbuildings	A roofer would charge you from $10 to $20. You can probably put it down yourself for about $5

that will withstand a "light" fire-spread hazard. To win any rating, the material must not throw off a flaming brand during a wind that may accompany the fire.

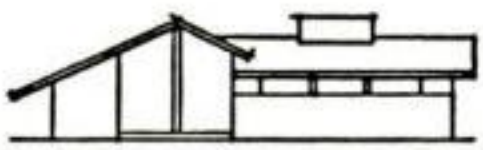
Urheberrechtlich geschütztes Material

Those Amazing New



Board-and-batten effect is achieved with Weldwood flat panels and individual battens, prefinished with DuPont's Tedlar. U.S. Plywood guarantees that this prefinished siding will need no painting for a minimum of 15 years.

New solid-vinyl siding is formed to shape shown here (in white). Dark part is composition backing.



IMPROVE YOUR HOME

By Ralph Treves

PREFINISHED siding once was a makeshift material you used in a never-successful attempt to bring a beat-up house back from the dead. Today, prefinished siding is so good they put it on new houses—and all over the country home owners are taking advantage of its long life to banish paint and upkeep problems for years to come.

What are its merits? There are four main ones:

1. You can often skip repairs by applying the prefinished material right over the old surface, regardless of condition.

2. You cut down on maintenance. This means not only less painting, but also no preparation for painting—which often can be as expensive as the painting itself. If you decide to change color—or to paint for any other reason—the siding is usually perfect as a base for as long as 15 or 20 years.

3. You get, with some prefinished materials, a fireproof rating.

4. You may find fuel bills coming down because of a tighter seal against the weather and, in some cases, increased insulation. Some home owners have reported fuel savings up to 25 percent.

What they're made of. Aluminum, steel, mineral fiber, vinyl, tempered hardboard, exterior-grade plywood, composition board, cedar or redwood shakes, lumber, and plywood are all used for prefinished siding.

The finishes are usually vinyl or acrylic, both noted for durability and colorfastness under exposure. These are either rolled or sprayed on and then usually baked for permanence. Sheet-plastic coatings are also bonded to backings under pressure. Solid vinyl is molded in clapboard shape.

Installation procedures vary for each type of siding. There are special nailing

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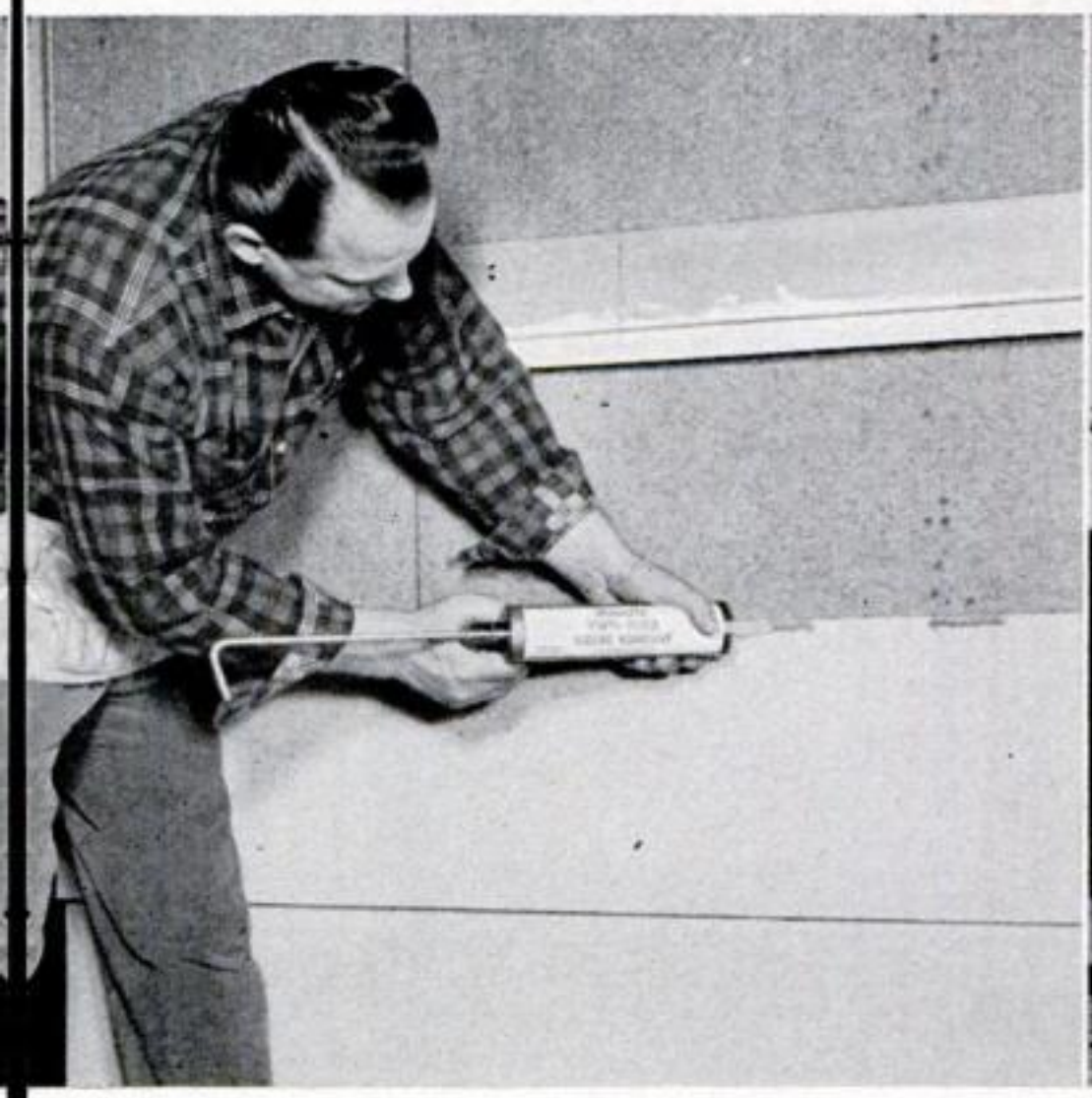
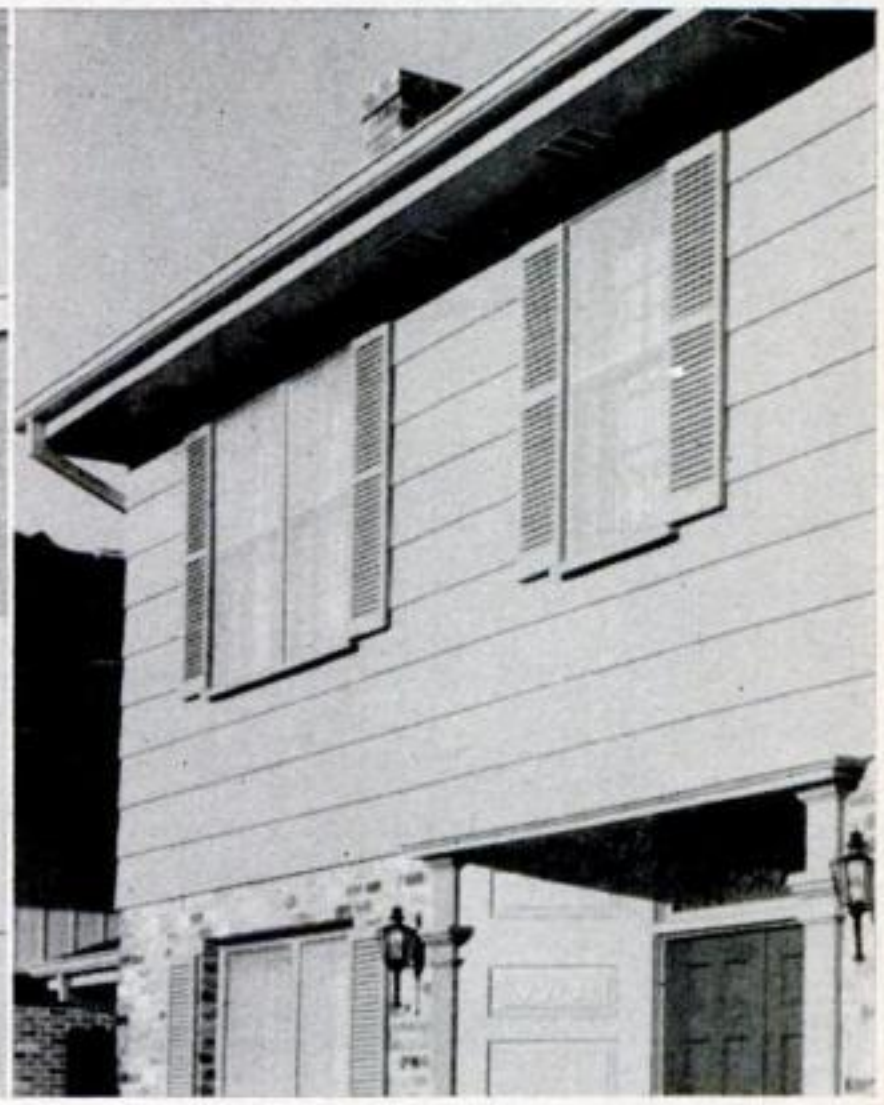
Urheberrechtlich geschütztes Material

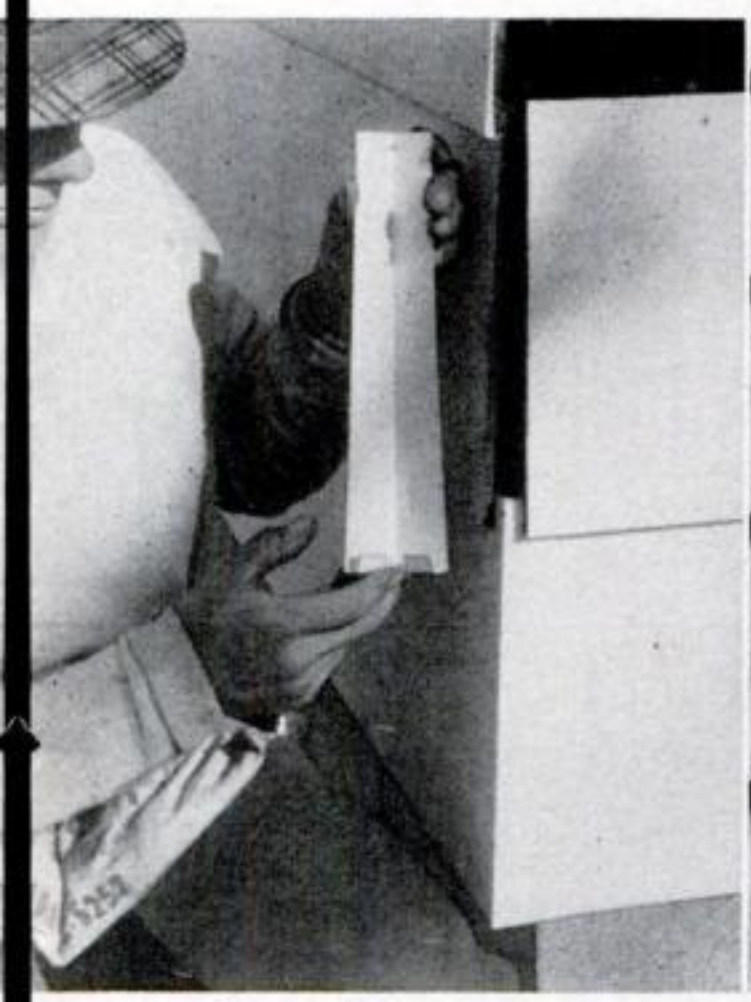
Sidings with Built-In Paint



Special adhesive is used to apply Insulite's Vinyl-Bond siding. The top edge of each strip is first nailed to the backing. Adhesive is then applied, also to top edge as shown here.



It looks like wood, but isn't. You can say this about many new sidings, including National Gypsum's Woodrock, above. The material comes in planks 12′ long, ⅜″ thick, 12″ wide.



Three corner treatments: Metal corner pieces finish off the Masonite Colorlok lap siding, as shown in photo at left. A nail at the top holds the corner in position. In the center photo, note how heavy shadow line is achieved by use of a backer strip under each course of mineral-fiber siding shingles. Special corners also finish off this type of siding. The intricate work of lacing real wood shakes at the corners has been eliminated by the Shakertown Corp., which furnishes the matching corner pieces shown in photograph at right.

Urheberrechtlich geschütztes Material

HOME OWNER'S GUIDE TO

COMPANY NAME AND BRAND	COATING	FORM	SURFACE	COLORS
ALUMINUM Installed price range—$80-$115 per 100 sq. ft.				
ALSCO, INC. Alsco Premium-30	Acrylic Tedlar (DuPont)	Horizontal and vertical lap panels	Smooth Smooth	Full range of colors White, gray, gold, beige, yellow, green, turquoise, aqua, blue
ALSIDE, INC. Alside Tuff-side	Acrylic enamel Acrylic	Horizontal and vertical lap panels	Smooth Embossed	White, blue, red, yellow, green, tan, brown, pink, gray Same as above
ALUMINUM CORP. OF AMERICA Alcoa	Alumalure enamel	Horizontal and vertical lap panels	Smooth, embossed	Gray, white, charcoal, green, brown, yellow, blue, beige, maroon
BENADA ALUMINUM Benada	Acrylic	Horizontal and vertical lap panels	Smooth	Basic colors
BRIDGEPORT BRASS CO. Flexalum Loc-on	Acrylic enamel	Horizontal and vertical lap panels	Smooth	Basic colors
MASTIC CORP. PVC-3	Vinyl (Sherwin-Williams)	Horizontal and vertical lap panels	Etch-grain	Wide choice of colors; list not available
SEARS, ROEBUCK	Baked enamel	Horizontal and vertical lap panels	Smooth	White, light green, gray, yellow, coral, charcoal, beige, maroon
TILO COMPANY	Acrylic enamel	Horizontal and vertical lap panels	Smooth	Basic colors
(Note: Reynolds Metals Co. produces aluminum for siding but does not do the actual extrusions. Siding made from this metal is often sold with the Reynolds trademark on the cartons.)				
LUMBER Installed price range—$60-$75 per 100 sq. ft.				
PACIFIC LUMBER CO.	Acrylic latex (Sherwin-Williams)	Clapboard	Smooth	As ordered
WEYERHAEUSER LUMBER CO.	Acrylic enamel	Clapboard	Smooth	White, golden yellow, silver gray, seafoam, desert sand
INSULATION BOARD SIDING Installed price range—$40-$60 per 100 sq. ft.				
MASTIC CORP. InselPlastic	Crushed ceramic in plastic	Clapboard	Smooth & pebbled	White, tan, variegated color
MINNESOTA & ONTARIO PAPER CO. Insulite	Vinyl (Sherwin-Williams)	Clapboard	Smooth	White, sandstone, green, gray
WOOD SHINGLES Installed price range—$40-$60 per 100 sq. ft.				
SHAKERTOWN Glumac	Acrylic stains	Shingles	Striated	14 colors
SUPRADOR CORP. Dua-Lap	Stained	Shingles	Striated	19 colors
PLYWOOD Installed price range—$95-$135 per 100 sq. ft.				
GEORGIA-PACIFIC CO. GPX Hypalon	Kimpreg acrylic (Kimberly-Clark)	Panels	Smooth	White, blue, yellow, green, gray
U.S. PLYWOOD CO. PF-15	DuPont Tedlar	Clapboard	Smooth	White, gray, green, beige, yellow
HARDBOARD Installed price range—$70-$95 per 100 sq. ft.				
MASONITE CORP. Colorlok	Videne (Goodyear)	Lap siding	Smooth	White, green, beige, gray

strips, corner caps, flashings, etc. Many installations require a vapor barrier such as asphalt-impregnated felt, impregnated gypsum, fiberboard, metal foil, or plastic film.

Nailing is a vital detail. Not only must the proper type of nail be used, but the nail must be driven so that the head does not crack or buckle the surface, draw it out of line, or prevent movement of the siding during expansion and contraction.

How to figure cost. The siding job is estimated on the basis of 100 square feet of wall area—called a "square." Prices vary with the type and quality of siding used, time required for wall preparation, method of application, use of insulation backer panels, trim, and so on.

Figure the number of squares in your house by multiplying the length and height of each outside wall to get the square

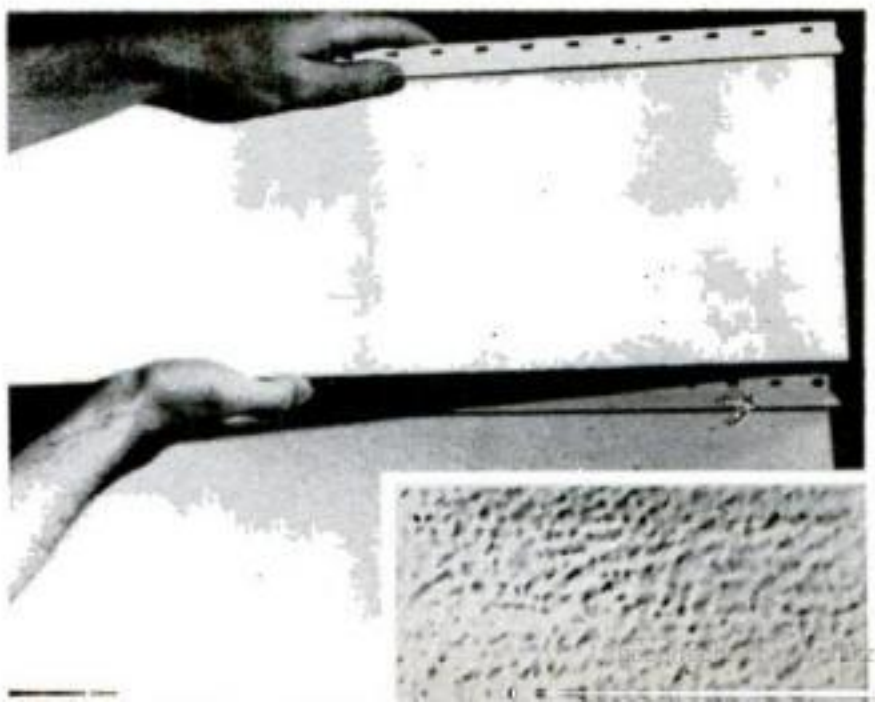
Urheberrechtlich geschütztes Material

PREFINISHED HOUSE SIDING

COMPANY NAME AND BRAND	COATING	FORM	SURFACE	COLORS
MINERAL FIBER (Asbestos-Cement) Installed price range—$60-$85 per 100 sq. ft.				
ALLIED CHEMICAL				
Barrett	Acrylic	Shingles	Striated	Brown, gray, white heather straw, rose, lime, nutmeg
Deep-grain	Acrylic	Shingles	Striated	Green, terra cotta, white, gray, brown
ATLANTIC ASPHALT & ASBESTOS, INC.				
Roctone	Acrylic	Shingles	Striated	White, light gray, dark brown, coral, light green, blue, charcoal, yellow, dark gray, light brown, dark green, red
FLINTKOTE CO.				
Pyroset	Acrylic	Shingles	Striated wood grain	White, beige, coral, holly green, dune yellow, cedar red, charcoal, shale gray, haze blue, dark green
Split Shake	Vinyl			
JOHNS-MANVILLE CORP.				
Rock-Shakes	Acrylic	Shingles	Striated	Aspen green, white, colonial yellow, canyon red, quaker gray, sandalwood, pewter gray
NATIONAL GYPSUM CO.				
Classic	Acrylic	Shingles	Striated woodgrain	White, sandstone, avocado green, Lambert green, cypress green, cedar red, lemonwood, birch gray, slate blue, charcoal, cinnamon
Deep-Tex	Acrylic	Shingles	Striated	Canyon red, muted gray, white, jonquil yellow, adobe brown, turf green
PHILIP CAREY MFG. CO.				
Styletex	Acrylic	Shingles	Striated	White, willow gray, lemon yellow, hemlock, dawn rose, palm green, sun tan
Ceramo	Acrylic	Shingles	Striated	Birch gray, sandstone, white, yellow, sage green, dusty rose, granite gray, alpine green, java brown, salem red
RUBEROID CO.				
Dura-Color	Acrylic	Shingles	Striated	Coral, aqua, pearl gray, spruce green, red, autumn brown, yellow, beige, green, charcoal
Dura-Shake	Acrylic	Shingles	Striated	
SUPRADUR CORP.				
Supra-tones	Acrylic	Shingles	Striated woodgrain	Velvet, tan, green, light & dark gray, brown, aqua, yellow, white, rose, red, dark green
Rancho	Acrylic	Shingles	Pebbled	Golden fir, redwood, poplar, white, spruce, sage
TILO CORP.				
Tilo	Acrylic	Shingles	Striated	White, grays, brown, coral, green, red, yellow, blue
SOLID VINYL Installed price range—$60-$75 per 100 sq. ft.				
BIRD & SON INC.				
Solid Vinyl	Vinyl	Clapboard	Smooth	White, ivory, gray, green
THE MASTIC COMPANY				
Mastic Vinyl	Vinyl	Clapboard	Smooth	White, gray, green, pink
MONSANTO CHEMICAL CO.				
Vinyl Siding	Vinyl	Clapboard	Smooth	White, gray, green, pink
STEEL Installed price range—$70-$100 per 100 sq. ft.				
ARMCO STEEL CO.	Baked enamel	Clapboard	Smooth	Wide range of colors
AMORGARD CORP. **GLOBE MFG. CO.** **SEAMAN-ANDWALL CORP.**	Acrylic enamels (Duracron by Pittsburgh Plate Glass)	Clapboard	Smooth	White and other colors to order

(Note: U.S. Steel Corp. produces zinc-coated steel which is supplied to processors but sold with the USS trademark.)

footage. Be sure to include roof gables and any extensions. Deduct the areas of windows and doors, and add 10 percent for wastage. Divide the result by 100 and [*Continued on page 179*]



Soft-texture surface is now available in aluminum siding. Alcoa has recently added 8″ embossed siding to its line. Close-up of the surface is shown in the inset.

COPPER TUBING: Key to

It's easy to expand your home water system with just a few simple tools and a little know-how

By E. F. Lindsley

COPPER tubing is the plumbing industry's gift to the guy who has a job to do on a water system but doesn't have a lot of pipe dies, cutters, and plumber's savvy. You can put in all the water pipe you need for most homes with a torch, hacksaw, file, and a few scraps of abrasive cloth or steel wool.

Just hack off the tubing, file the burr, polish the tube end and fitting socket, smear flux on the cleaned areas, and solder.

Soft copper tubing comes in almost any length you might need. It's easily cut and connected, and you can bend corners anywhere. For remodeling work, it can be snaked through walls and eased past barriers that would be hopelessly frustrating with rigid iron pipe and threaded fittings.

On the other hand, rigid copper tubing can be laid in and lined up as neat as teeth on a comb. In horizontal runs (which should pitch about ¼" per foot towards a drainage point) rigid tubing's backbone keeps the line free of low spots which might freeze up on you some day.

When buying copper tubing, keep in mind that there are three types, K, L, and M, each having different wall thicknesses. K is the beefiest, L is medium, and M is the thinnest. You can get K and L in both soft and rigid, but M only in rigid. Soft tubing can be joined with either solder or flare fittings. Rigid can't be flared, so solder fittings only are used.

Check your local plumbing code to find out what the law says about copper tubing

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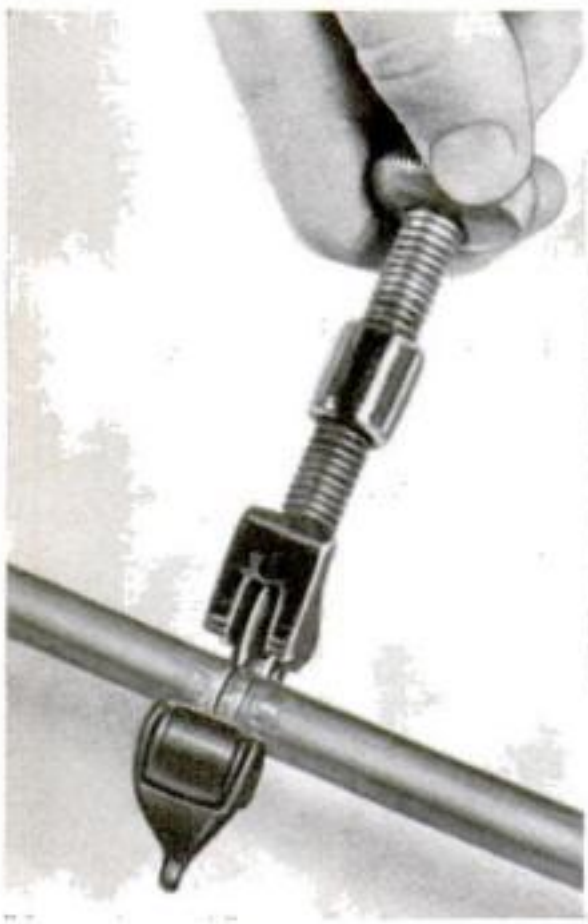
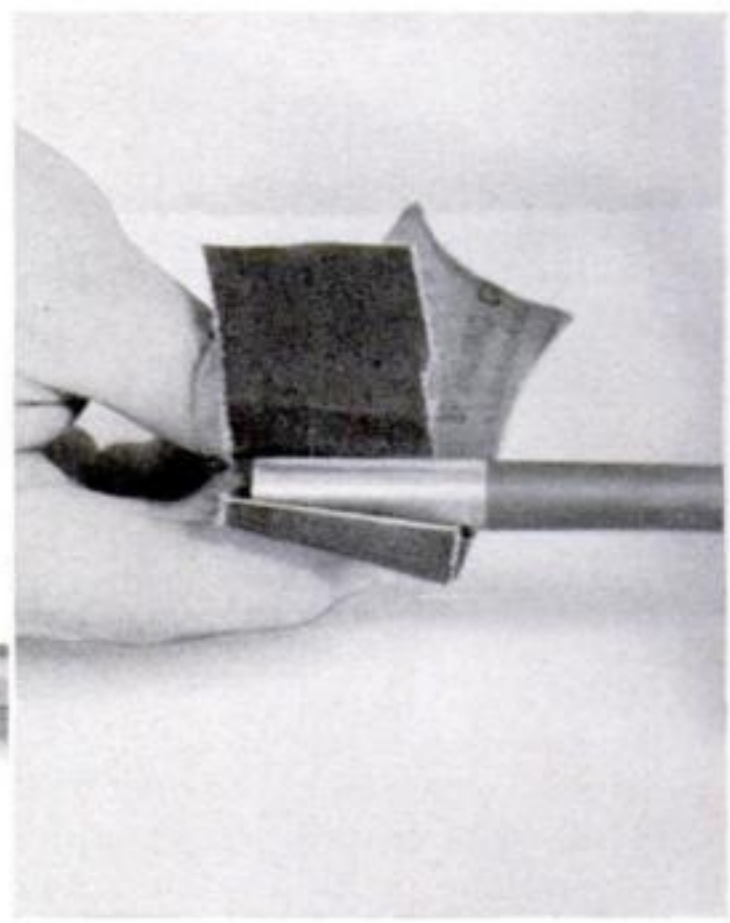
Six steps for making a perfect solder joint



1 **Use a tubing cutter** if it's more convenient than a hacksaw, but don't force the rate of cut. Too much pressure causes the wheel to spiral. Don't try to flare an uneven tubing end.

2 **Use the reamer blade** on the tube cutter, or a countersink, to remove flow-restricting inner burr caused by cutting. A file should be used to clean up and square off end of tubing.

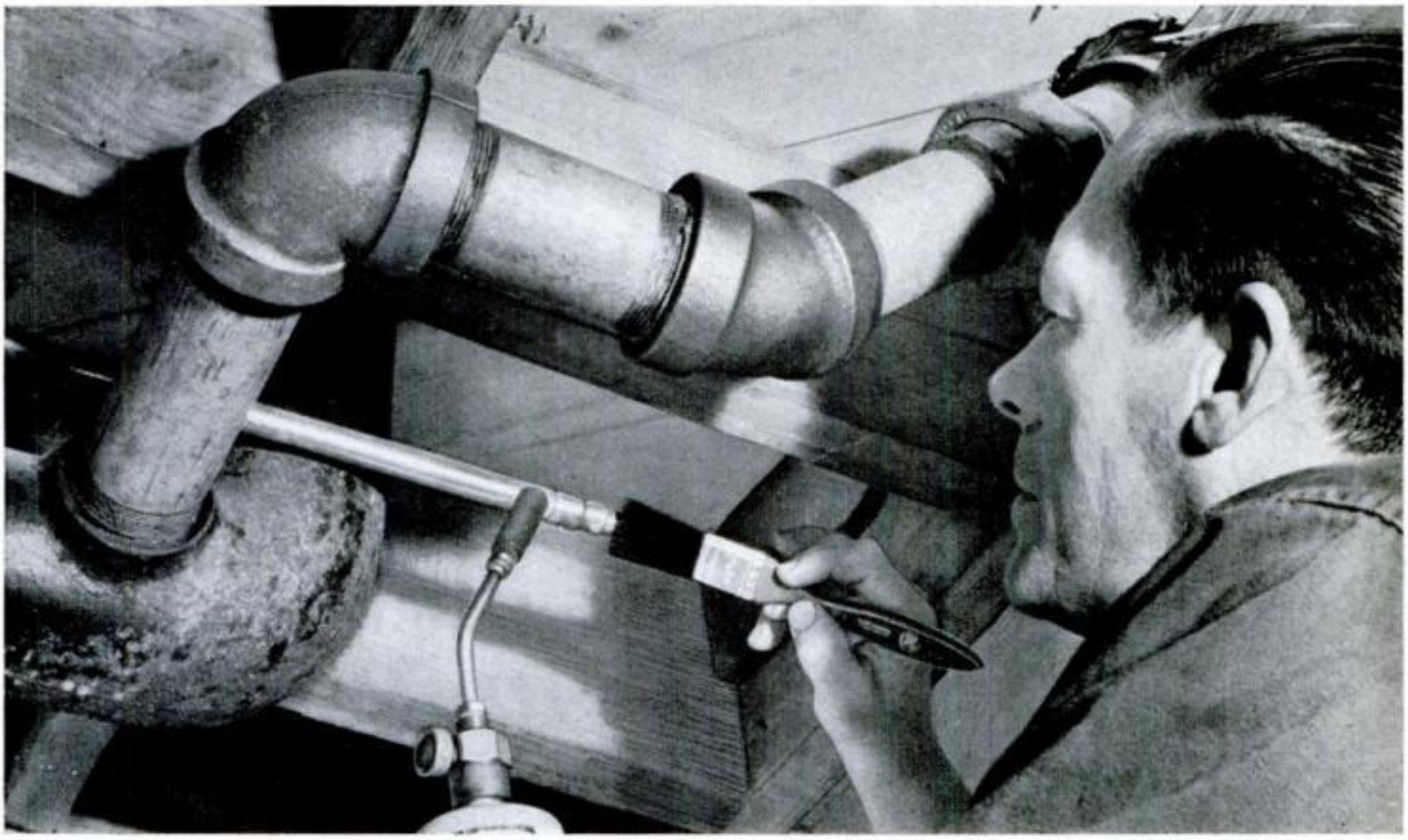


3 **No matter how bright** tubing looks, clean it thoroughly with steel wool or fine abrasive cloth so solder will adhere. Good joints start here and repairing bad ones is not much fun.

Urheberrechtlich geschütztes Material

Easy Plumbing

IMPROVE YOUR HOME



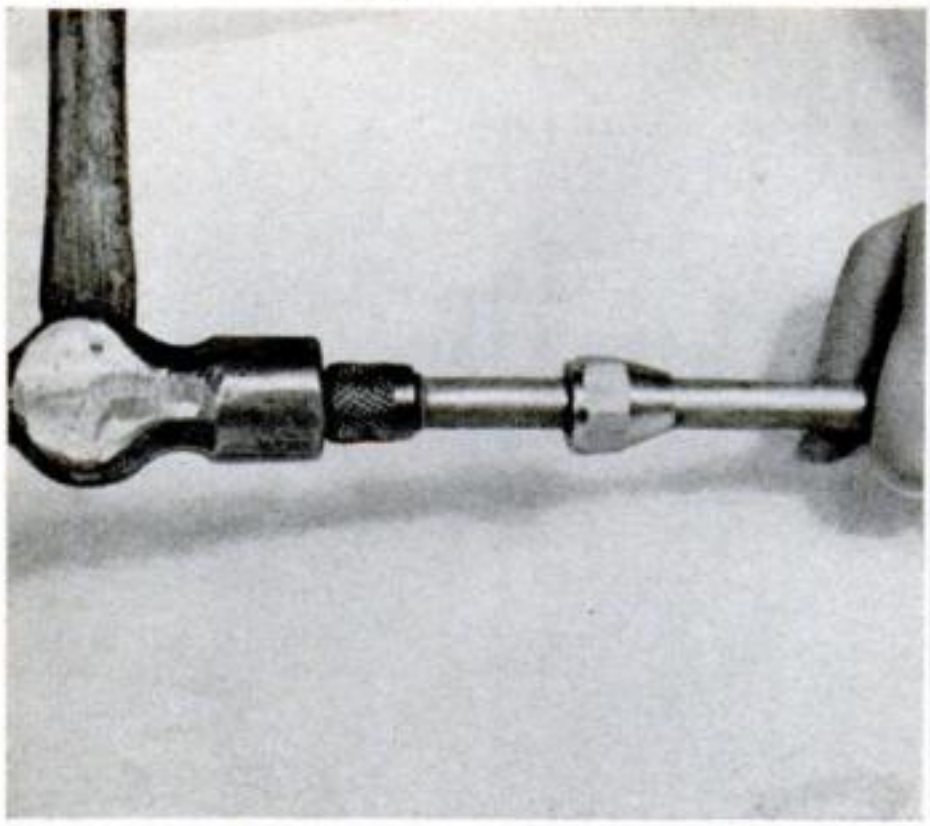
4 **Special cleaning tool** shown here, for fittings, is very handy, but steel wool or fine abrasive cloth works about as well. The tool size must match the fitting size in order to work.

5 **Apply paste flux** just before soldering. Although it is not absolutely necessary to disassemble the valve, doing so prevents heat damage to valve-seat washer and stem packing.

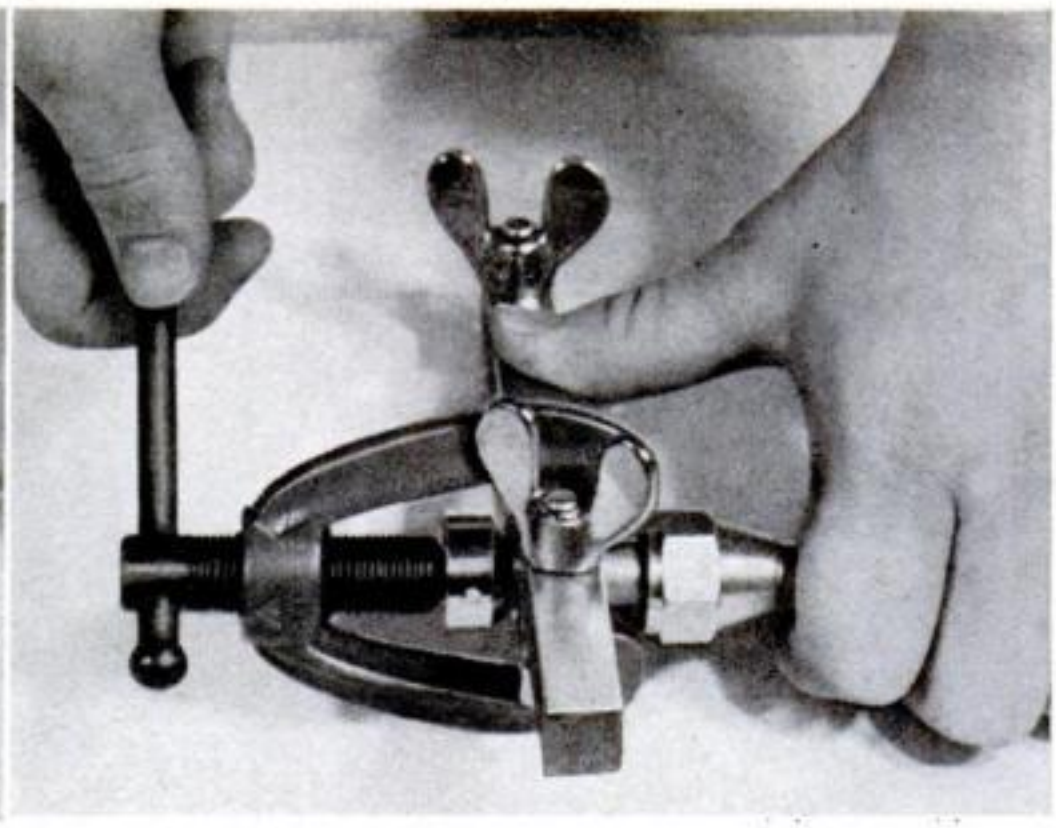
6 **Heat fitting** with torch until solder melts and flows freely into the joint. Feed solder until the joint takes no more and a blob forms at low point. Wipe off excess solder and let cool.

Urheberrechtlich geschütztes Material

These two types of tools help you make flare joints



One way to flare soft tubing is to insert and hammer a small flaring tool while holding tubing with other hand. Results can be less than perfect, but method is practical and the tool is cheap.



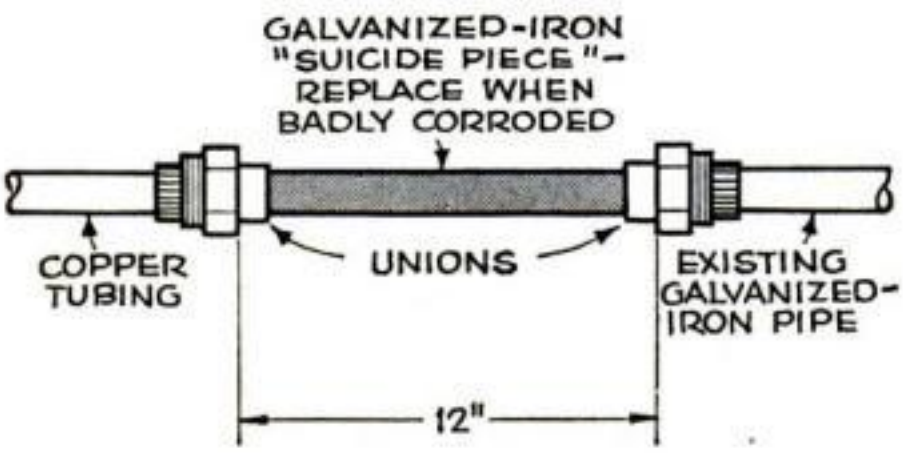
Screw-type flaring tool shown above costs about $5. It gives surer results and is easier to use, especially if the end of the tube is in a tight spot. Flaring cone is screwed against clamped tube.

and which type you should use; but in general, type L is a good, safe bet for most home water systems. Use type L soft tubing for below-ground installations.

Plumbing people specify tubing size by the inside diameter. If you find that the numbers on a tubing bender or flaring tool are one size too small for the tubing size, it's because these are automotive or aircraft items that are marked according to outside diameters. Best bet—take a sample of tubing with you when buying tools.

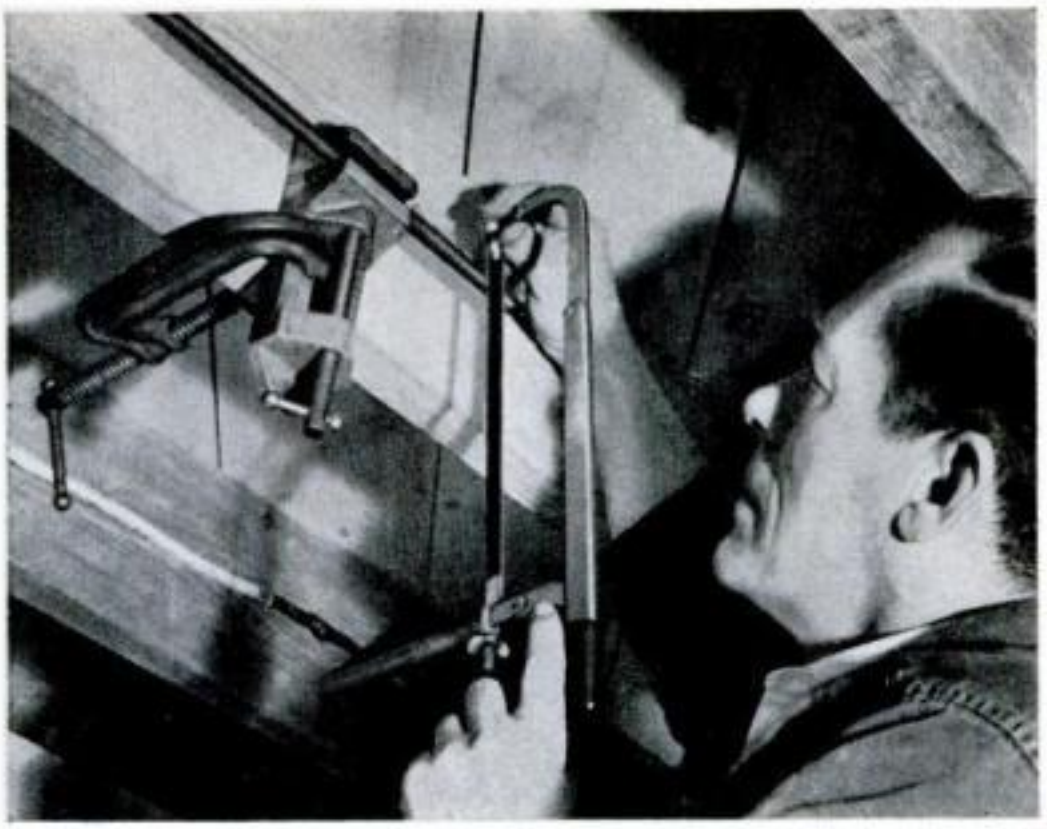
Fittings. Most of the fittings you might need are shown at right. Use stop valves in the line to shut off sections of the system for repairs or draining. A stop-and-waste valve has its own drain plug. Use couplings

[*Continued on page 174*]

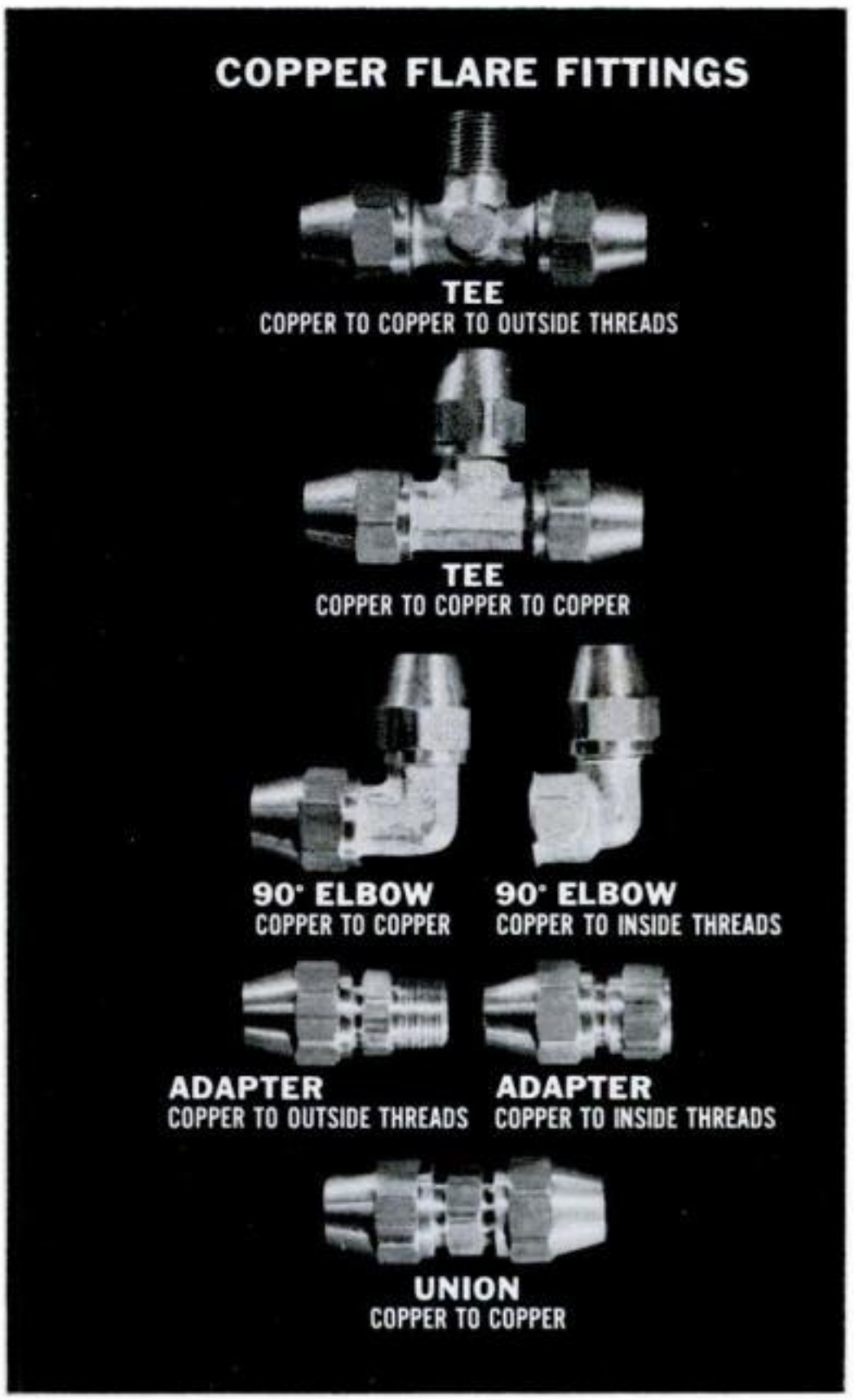


If electrolytic corrosion is a problem, put in a "suicide piece" between existing galvanized-iron pipe and copper tubing. Since corrosion attacks the first 6" or 8" of iron pipe only, you can easily replace damaged section if you install a 12" piece of iron pipe with a union at each end.

Urheberrechtlich geschütztes Material



Drill-press vise and C clamp, as above, or a small miter box, are a lot better than holding the tubing by hand for cutoff. The neater the cut, the better and easier the joint goes together.



DO

Check your local plumbing code for any special requirements.

Drain every bit of water out of the section you are working on.

Use flare fittings if a fire could start.

Make a square cut and remove burrs.

Clean both tube end and fitting socket with abrasive cloth, steel wool, or wire brush.

Apply soldering flux to both tube end and fitting socket.

Make sure that the tube is in tight against end of socket and that tube and fitting are aligned. Twist slightly to spread flux.

Assemble and solder as much as possible on floor or bench before installing.

Apply torch flame to fitting only. Keep flame in motion, to heat as large an area as possible. Let joint cool naturally.

Support tubing with straps; put drain plugs or valves with drain plugs at low spots.

When assembly is complete, test joints by turning on water.

DON'T

Try to bend and reshape soft copper tubing too many times. It work-hardens.

Attempt to bend or flare rigid tubing.

Use coarse abrasives for cleaning, and don't overdo and remove metal.

Use acid flux or acid-core solder.

Try to make sharp bends in soft tubing without a bending tool.

Clean soldering surfaces and apply flux until you are ready to solder.

Overheat joint, since you may burn flux.

Keep flame on fitting after it is hot enough to melt solder.

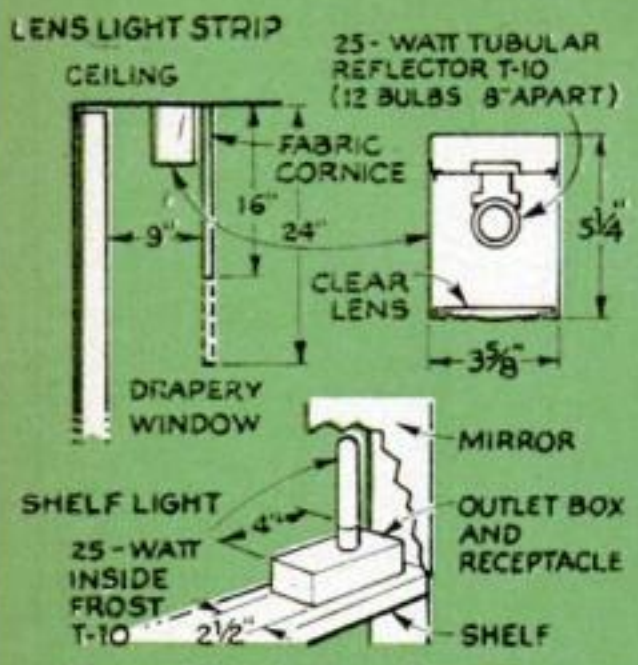
Use fingers to apply flux—you might accidentally get it in your eyes.

Put torch flame directly on solder. The solder will be drawn into the joint whether the solder is fed upward, downward, or sideways.

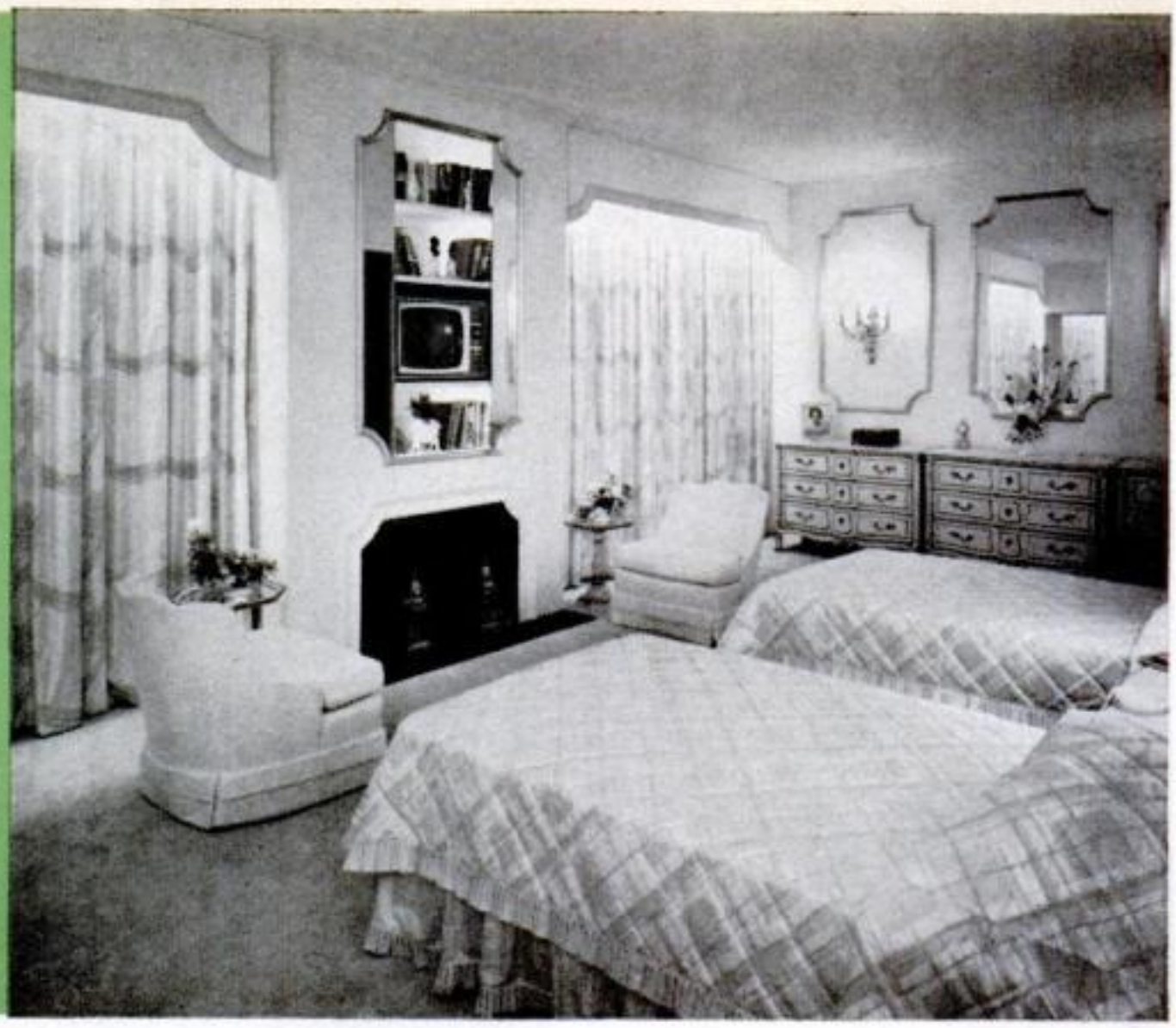
Forget to remove surplus solder and flux with a rag or brush while joint is still hot.

Hesitate to open and redo a suspicious-looking joint.

Urheberrechtlich geschütztes Material

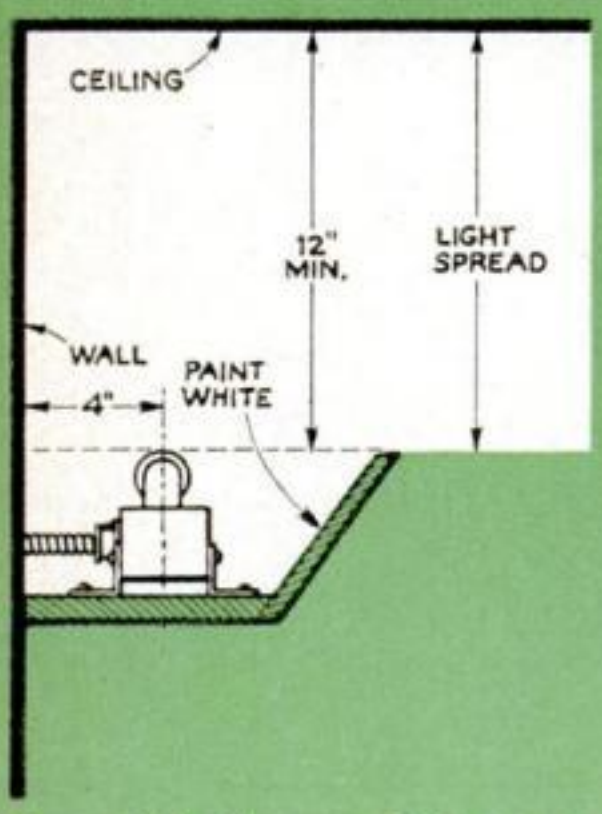


Room lighting used in Westinghouse Dream Home at World's Fair (photos) can be adapted to many homes. Tubular incandescent bulbs in bedroom permit low-level lighting without dimmer switch, avoid fluorescent hum. The bulbs in the cornice are the showcase type and have a built-in reflector.

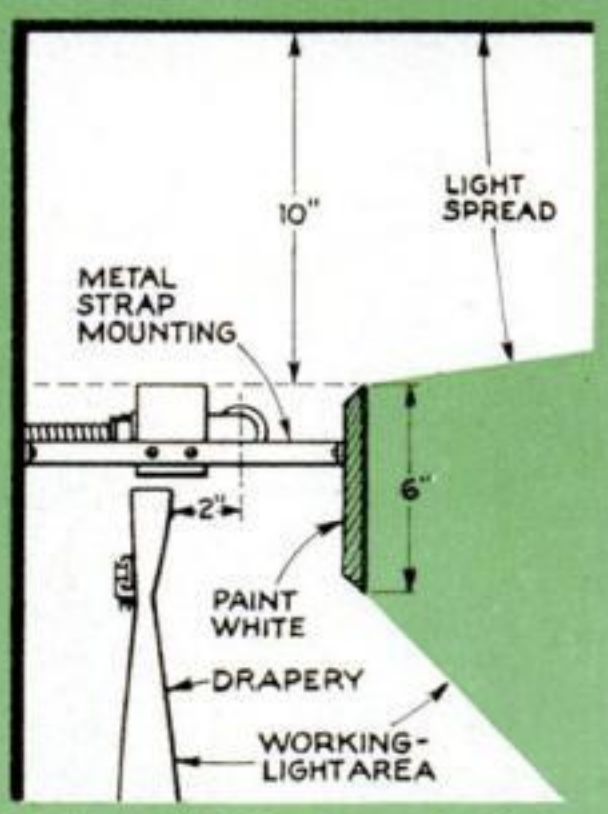


PS Money-Saving Series: Improving

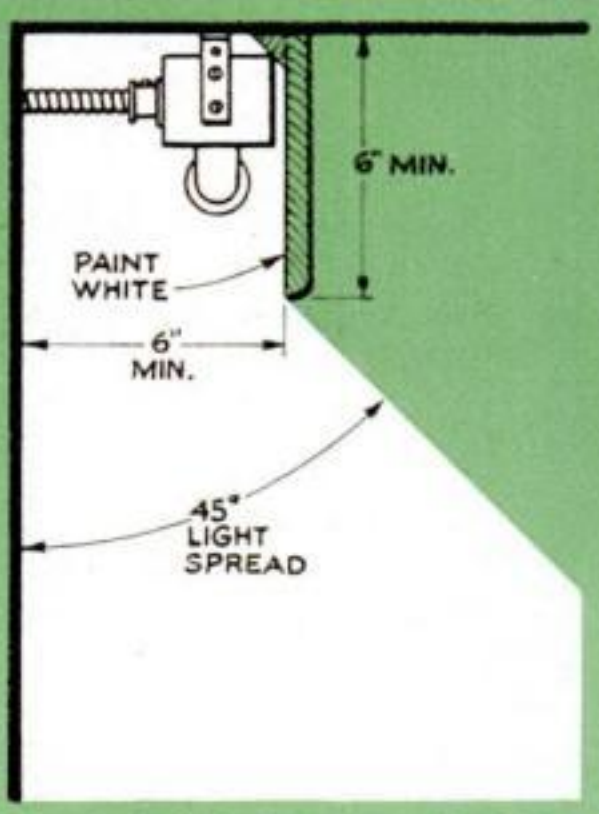
Three types of indirect lighting



Cove light bounces light from ceiling only, requires light-colored ceiling, provides soft, low-level area lighting. It's good for accenting architecture of slanted "cathedral" ceilings.



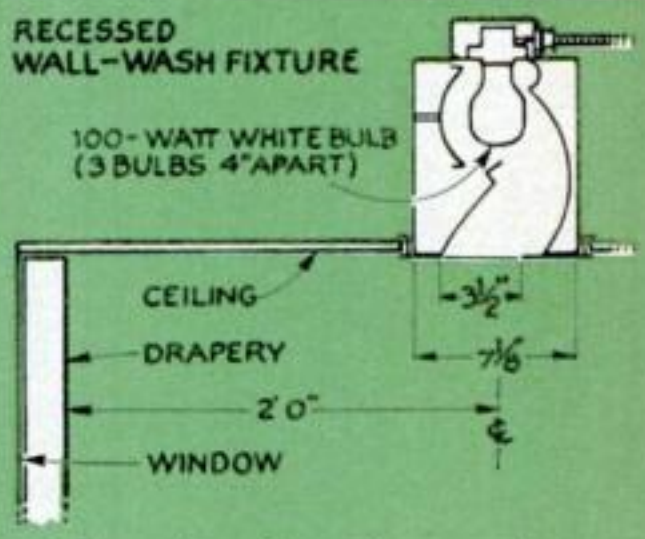
Valance lighting is used above window, bounces light from ceiling, also spreads it over drape below. Face board shouldn't be less than 6" wide. Nominal 8" lumber is good for most jobs.



Cornice lighting spreads light down over wall only, making low-ceiling room look higher. It also emphasizes wall textures, lights up pictures. Good in basement recreation rooms.

Urheberrechtlich geschütztes Material

IMPROVE YOUR HOME



Wall-wash ceiling fixtures light drapes at immediate left. Recessed units are 3′ apart, contain three 100-watt bulbs each, to create effect shown. They are mounted in the ceiling, as illlustrated in the sketch above.

Your Home Wiring

By George Daniels

THIS MONTH: Installing new light fixtures

YOU don't have to be an electrician to install lighting fixtures or built-in lighting systems. The job isn't much different from running an extension cord from a plug-in receptacle to a pin-up lamp on the wall. The simplest jobs require as few as four wire connections, lavish ones usually less than a dozen. The rest is plain carpentry. But before you can run wires, you must understand the mounting of fixtures. Special hardware is involved. We'll discuss the hardware this month, and keep the wiring instructions for another complete article in October.

Make an overall room-lighting plan, based on eye comfort. When normally lighted, the room should have no dark areas. The reason: If you sit in a bright part of the room to read, with shadows in your line of vision, your eyes will constantly try to adjust from one to the other, and tire quickly. So you need well-lighted walls. Several of the built-ins shown in the drawings do the trick. And there's a bonus: Lighted walls appear to recede, visually, making a room look bigger.

Place your fixtures so the lamps are out of the normal line of vision. A direct view of the light source, even out of the corner of your eye, is unpleasant.

If you use built-ins for overall general lighting, pick supplementary fixtures that will give you higher-level localized lighting. Use a recessed spot or flood to hit the working area of a counter or to highlight a wall feature or a painting.

Built-in lighting. Many rooms benefit from built-in lighting (often called structural lighting by the pros). Cove lighting shines only upward, requires a highly reflective ceiling, and is relatively inefficient. Its light is indirect and highly diffused. Use it where you want soft, low-level lighting.

Cornice lighting shines downward, spreading light over a wall or drapery. As its light rakes the surface it emphasizes

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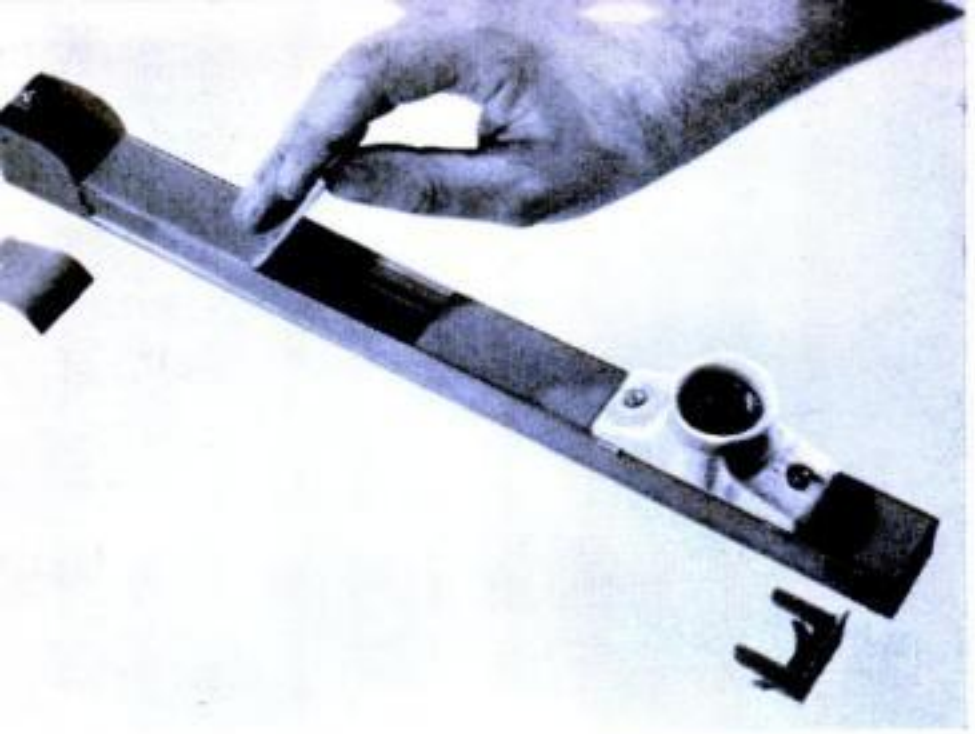
Urheberrechtlich geschütztes Material



A row of bulbs for built-in lighting is easy with raceway like Plugmold 2100. Break-out sections of metal cover permit mounting sockets as close as 3" on centers. Cable feeds it.

texture. Built properly, cornice lighting also provides working light below it in a 30- to 45-degree angle from the lamp's center. Use this type to increase general illumination, make a room look bigger, and provide close-to-wall lighting.

Valance lighting shines both upward and downward, bouncing light from ceiling and wall for better efficiency than either cove or cornice. It's usually used above a large window area to provide a lighting effect when the drapes are drawn. Use this when you want efficient diffused light plus the combined effects of cove and cornice.

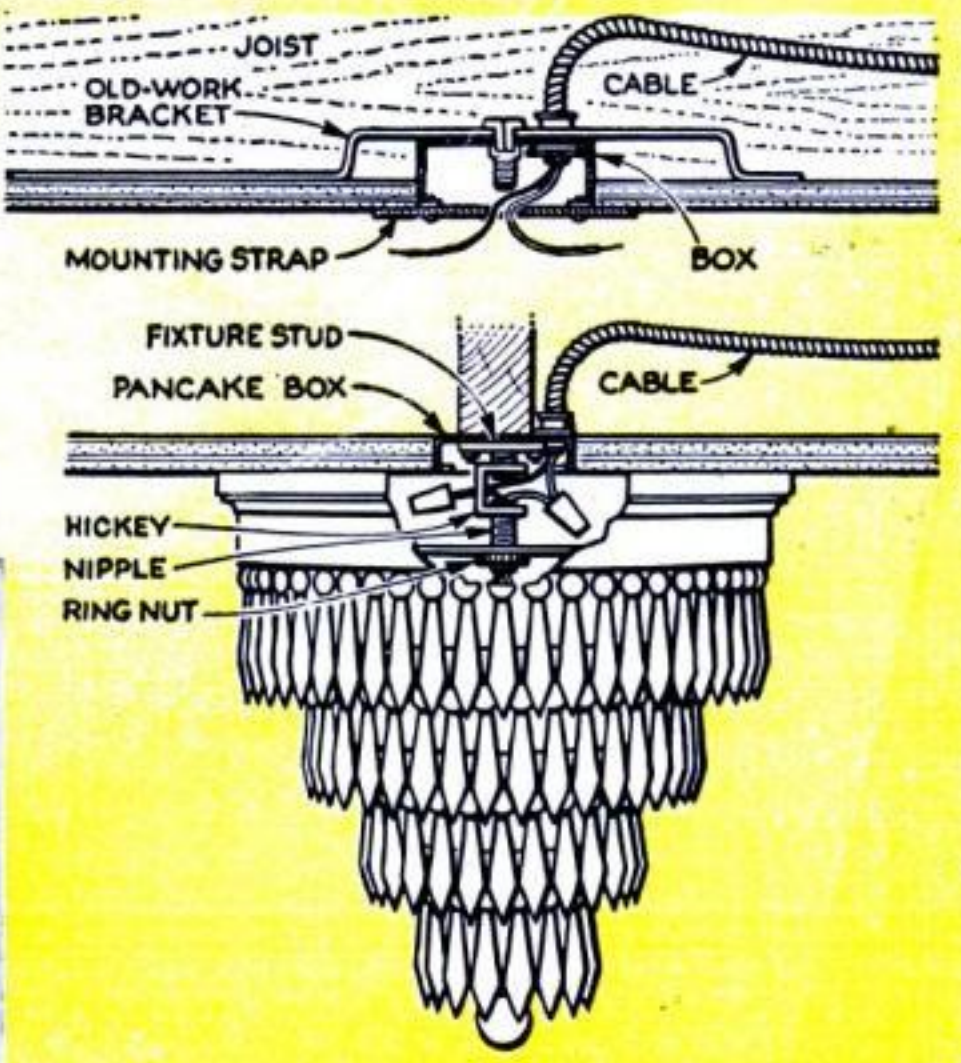
Recessed lighting may take the form of a built-in soffit or a ready-made fixture. The soffit is a panel built into the under-

How to install ceiling and wall fixtures

Mounting straps like these can adapt almost any lighting fixture to standard box mounting. Center holes are for studs. Screws with ornamental nuts seen at upper left are a stock item.

Fixture studs, hickeys, and nipples vary widely to match different fixtures. Stud mounts in box. Hickey links it to the nipple, adjusts length, and allows fixture wires to enter the nipple.

Two common types of box used in mounting ceiling fixtures are shown below. Octagonal junction box with "old work" offset hanger bar may be used as at upper right for average fixtures. Round pancake box is shallow enough to mount directly to joist for heavy fixtures, as at lower right. It may also be used with straight hanger bar for average fixtures. If there's an unfinished attic above and you can get into it easily, your best bet is to mount fixture box on "new work" hanger nailed to joists on both sides of fixture location. As a general rule for easy wiring, use the largest box that the situation permits.



Urheberrechtlich geschütztes Material

side of a part of the room structure, such as the underside of a beam or header above a room entrance. Its light is diffused by a translucent plastic cover. Recessed fixtures may provide either spot or diffused light, depending on design. In all types, heat must be kept away from combustible materials. Allow at least ½" clearance between fixture parts and house structure at all areas except points of attachment to the wall or ceiling.

Mount coves as far below the ceiling as room proportions permit. This lets the light spread before it hits the ceiling, providing a larger reflective area and eliminating the chance of streak light. Follow the same idea in setting the lights of valances and cornices away from the walls of the room.

Fluorescent or incandescent? Fluorescent lighting works well with this type of built-in as the units can be mounted end to end for an uninterrupted run of light. Strip lighting is the most economical fluorescent form. It consists of plain white-enameled metal boxes containing the circuit parts and carrying a tube mounting at each end. But even in this form, a 40-watter (4′ long) costs around $8, considerably more than the same amount of incandescent-bulb lighting.

Once installed, however, it provides up to three times more light per watt than bulbs, and tubes last 5,000 hours or more in average use. Do not mount fluorescent

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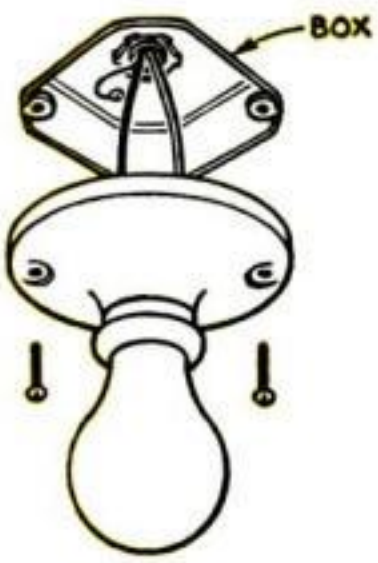
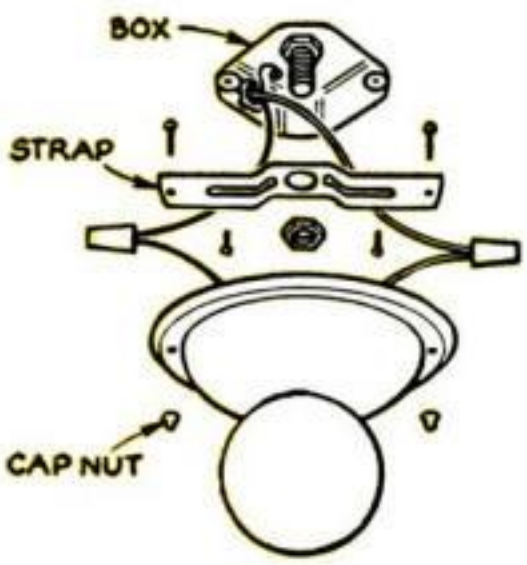
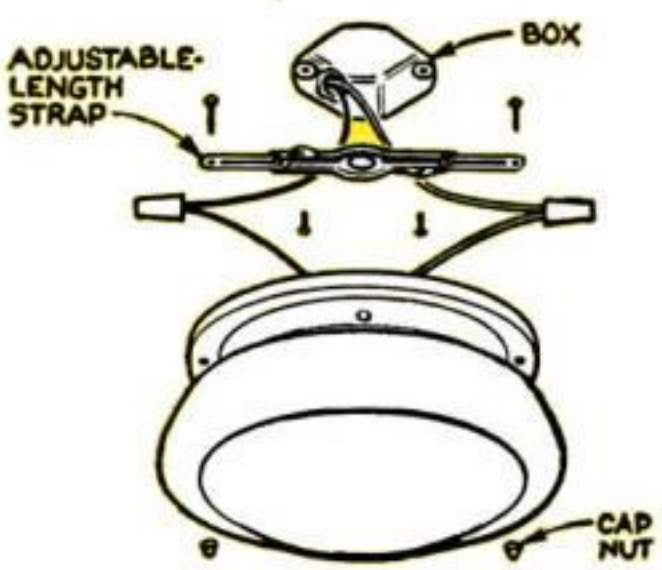


Simplest mounting for ceiling light is this one, with cable wires connected directly to porcelain socket terminals. The socket has screwholes to match box. Sockets like the one pictured are available with pull-chain switch, also single plug-in outlet.

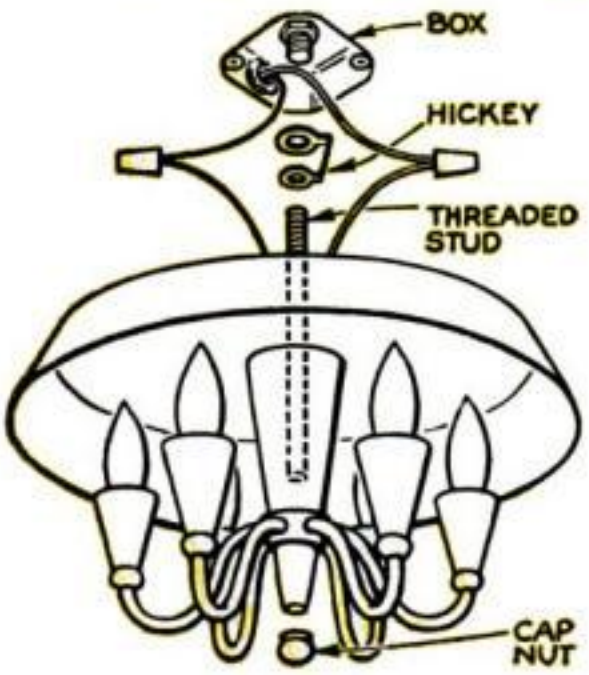


If box can take a stud, attach the mounting strap to it. If not, use screws upward through the strap slots into threaded holes in the box, after setting downward-pointing screws in place in the ends of the strap to hold the lighting fixture securely.

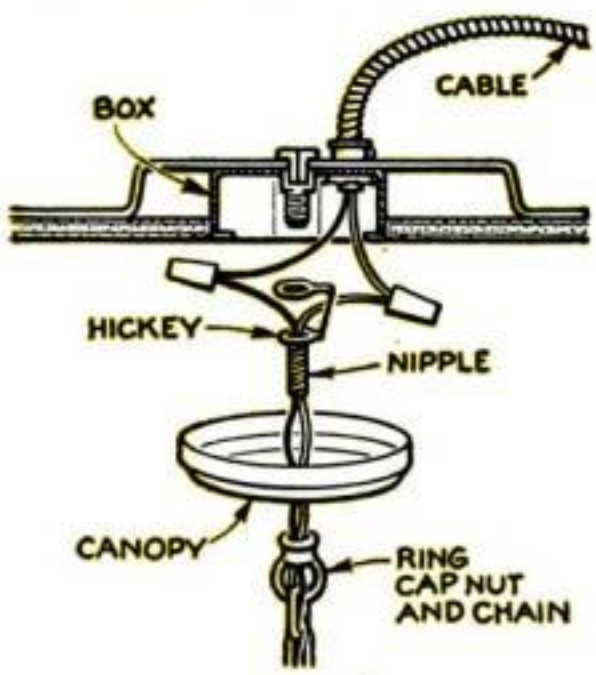


Extension-type strap is used to mount very wide or large-diameter fixtures. It may be attached to the box with stud or screws. As screws are nearer the strap ends, favor this mounting for heavier fixtures. Wires run around the sides of the strap.

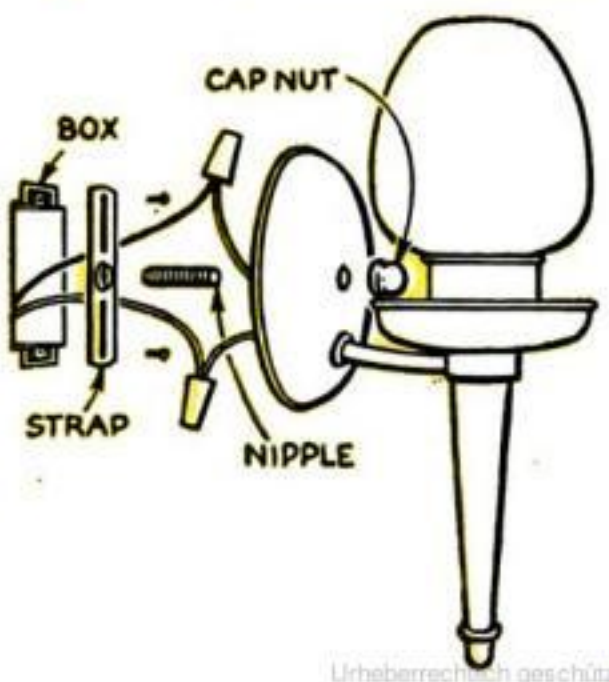
If wires need not run through dome or canopy of fixtures, bolt or solid threaded rod may be used from hickey downward. Hickey screws on to stud in box, is used merely to adjust overall length of mounting, like turnbuckle. Cap nut snugs it all up.



If wires must pass through dome or canopy of fixture, they enter lower nipple through hickey, as below. If wires run down chain, eyenut is used at top of the chain. Wires weave through the chain. This type of nut is stock item at electrical suppliers.

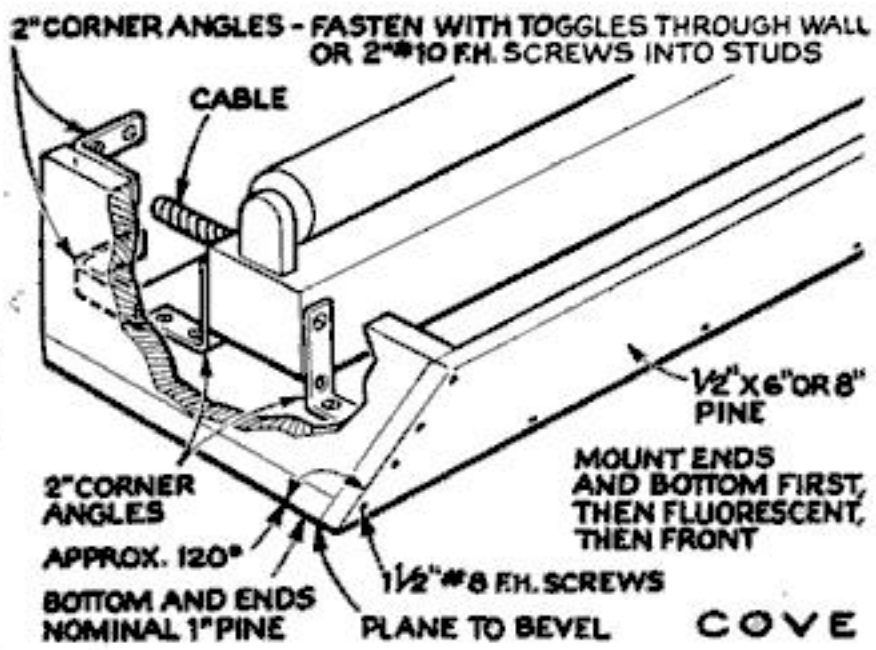


Common wall fixture has a mounting strap attached to the wall box with screws into threaded holes in tabs at ends of box. Nipple screws into threaded hole in the center of strap, and takes an ornamental cap nut on outside of fixture.

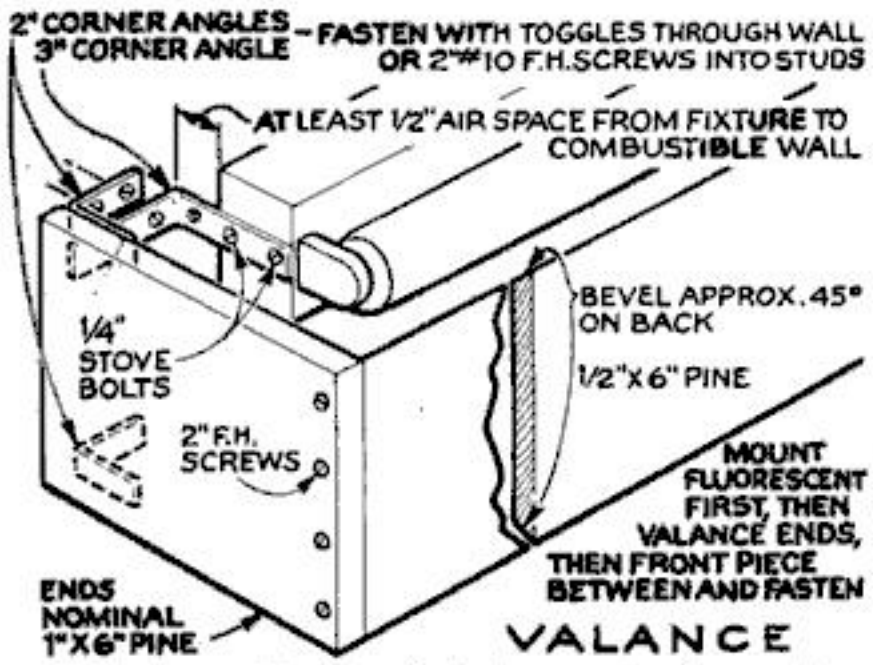


Urheberrechtlich geschütztes Material

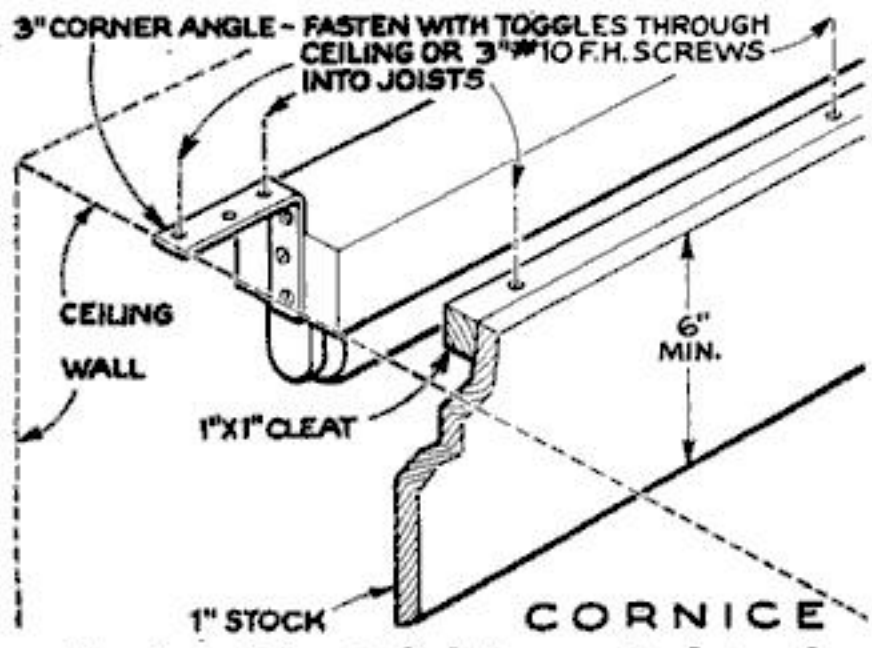
How to build your own indirect lighting


2" CORNER ANGLES - FASTEN WITH TOGGLES THROUGH WALL OR 2" #10 F.H. SCREWS INTO STUDS
CABLE
1/2" X 6" OR 8" PINE
MOUNT ENDS AND BOTTOM FIRST, THEN FLUORESCENT, THEN FRONT
2" CORNER ANGLES
APPROX. 120°
1 1/2" #8 F.H. SCREWS
BOTTOM AND ENDS NOMINAL 1" PINE
PLANE TO BEVEL
COVE

Cove unit: Mount ends and bottom first, then lighting unit, then front panel. Space above the tube permits easy lamp replacement.


2" CORNER ANGLES
3" CORNER ANGLE
FASTEN WITH TOGGLES THROUGH WALL OR 2" #10 F.H. SCREWS INTO STUDS
AT LEAST 1/2" AIR SPACE FROM FIXTURE TO COMBUSTIBLE WALL
1/4" STOVE BOLTS
2" F.H. SCREWS
BEVEL APPROX. 45° ON BACK
1/2" X 6" PINE
MOUNT FLUORESCENT FIRST, THEN VALANCE ENDS, THEN FRONT PIECE BETWEEN AND FASTEN
ENDS NOMINAL 1" X 6" PINE
VALANCE

Valance: Mount lighting unit first, then endpieces. Next mount the front, its inside painted white. Replace tube from below.



Cornice: Mount lighting unit first, then cornice board. Cleat holds it to the ceiling. Beveled siding stock is a good material to use.

housings directly on low-density wallboards (like Celotex). Use a metal bracket to provide air space between the unit and the wall because of the heat generated by the ballast coil in the fluorescent circuit. The accompanying sketches indicate the spacing needed.

If you use bulbs, the easiest way to mount them in a closely spaced row for even lighting is on a multi-outlet raceway such as Plugmold 2100 made by the Wiremold Co., Hartford, Conn. This can be fitted with special sockets to set bulbs as close as 3″ on centers. Select the bulb wattage that creates the effect you want. Typical valance lighting: six 25-watt bulbs.

Except in work areas, use bulbs or fluorescent tubes with a warm (pinkish) tint. (Trades names like GE's Dawn Pink indicate warm-tone bulbs.) If you want to vary room colors, experiment with lights of more pronounced color.

Mounting the fixtures. Many small wall and ceiling fixtures are designed for screw-mounting directly to the threaded holes in a standard wall or ceiling box. Others come with a mounting strap that fits a standard box and attaches to the fixture by other screws or a threaded central stud. If you mount an adapted antique or foreign fixture, or other offbeat type, check the wide variety of mounting hardware stocked by any electrical supplier. You'll find one or a combination of several that will do the trick. An assortment is shown in a photo on the previous page. Many others are available.

The method used to mount a ceiling fixture depends on the weight of the fixture. Most types may be mounted on a box supported by an "old work bracket" that rests on the upper surface of the ceiling, between joists. Heavier units are often mounted from a pancake box screwed directly to the bottom of a joist. This type of box is barely deeper than the thickness of the plaster or wallboard, so is easily concealed by the canopy of the fixture. It's also a wise choice where an average fixture must be mounted in an old ceiling of doubtful strength. ■■

NEXT MONTH: Wiring new light fixtures

Urheberrecht ch geschützt Maxtra

Design Your Own Fence with Modular Sections

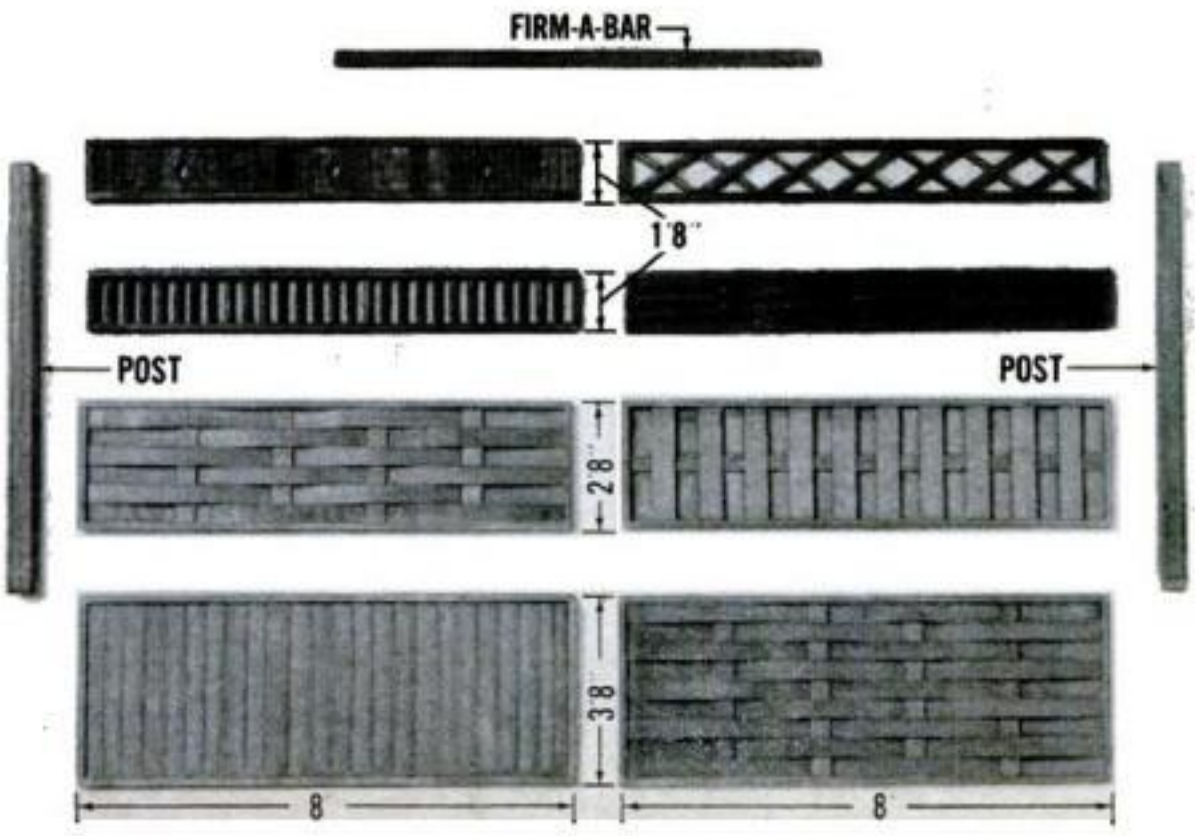
DO YOU want yard privacy for sunbathing or entertaining, yet can't find a standard fence design to suit your taste—while the cost of a custom-built fence is too hard on the family budget? You can solve this dilemma with a new assemble-it-yourself modular fence that goes together in thousands of combinations to fit your needs.

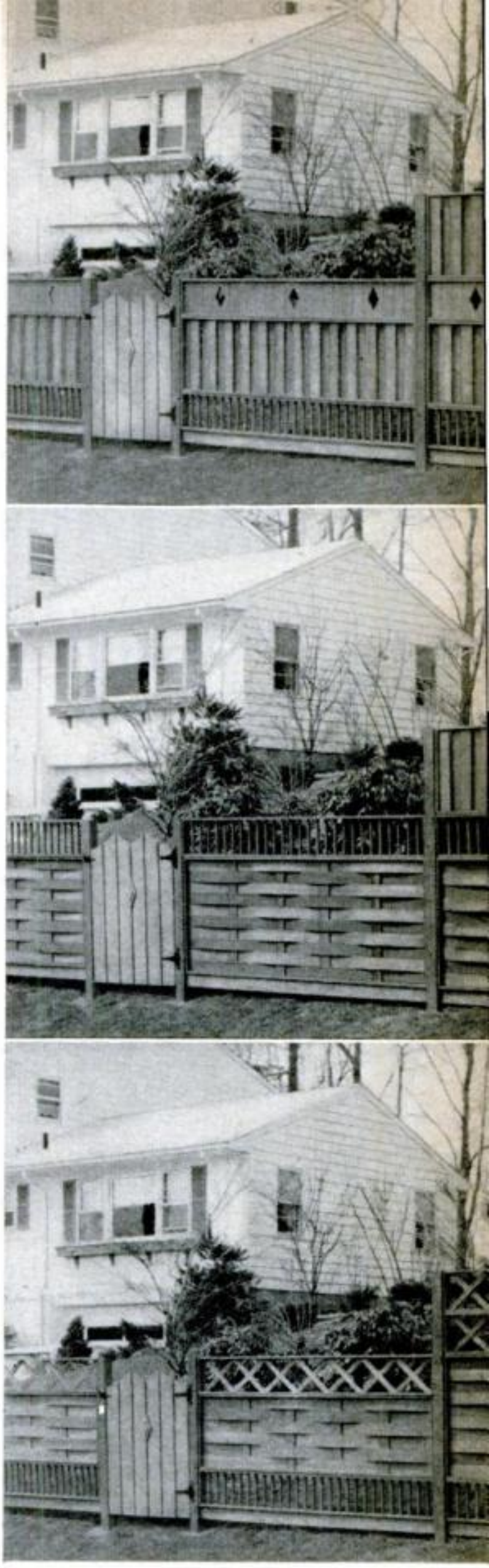
Called Mix 'N' Match, it was created by Frontier Fence Corp., Smithtown, N.Y., to provide custom-designed fencing for the cost of mass-produced standard types. The modules come in eight different interchangeable patterns, and the posts are sized for 4′, 5′, or 6′ fences.

The modules are made of rot-resistant red cypress; the posts are pressure-treated yellow pine, guaranteed for 30 years.

The heart of the new fence is the Firm-a-Bar, which attaches to the fence posts with brackets and carries the weight of the modules. The modules are stacked on the bar to the height of the post.

If you hanker to do it yourself and save money, the modules are so light that one man can put up 80 feet of the fencing in about 2½ hours' working time.



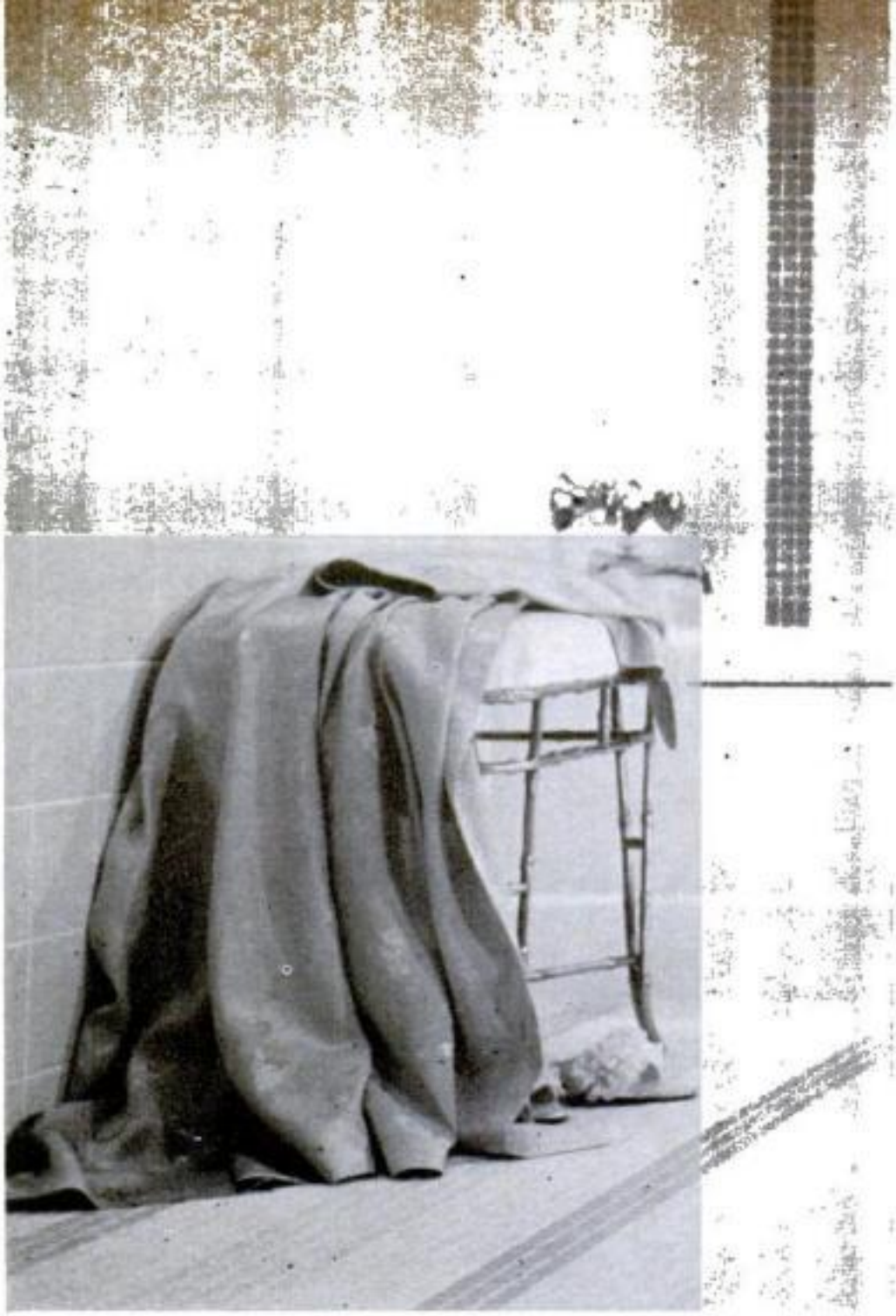


Distinctive fences shown above are examples of some of the numerous designs you can create with the interchangeable sections at left. Available from fencing dealers, the preassembled wood modules are easily put up by one man.

Urheberrechtlich geschütztes Material

IMPROVE YOUR HOME

3 Steps to Installing Ceramic Tile ...Anywhere



CERAMIC tile gets better looking, more popular, and cheaper every day. For 60 cents to a dollar a square foot, you can choose from an ever-widening selection of classic squares, feature squares, or jewel-like mosaics. Sold in easy-to-handle sheets, the mosaics and small squares are as simple to install on floor or wall as wallpaper or floor tile. In addition, foolproof adhesives make ceramic tile ideal for many tables, counter tops, and bathroom built-ins.

Ceramic tile has now all but reached the dime store. Specialty outlets, discount houses, mail-order catalogues, and many neighborhood shops handle tiles (sometimes on hand, sometimes on quick order) and the tools and adhesives you need. Usually they can provide detailed instructions.

It's a job you can easily do yourself in bath or kitchen

By Jackson Hand

Spreading the adhesive. Mastics for ceramic tile, indoor and outdoor types, come

1 **Notched spreader** has serrated edge that leaves ridges of mastic the proper height to compress to correct adhesive line under tiles. Smooth out any lumps.

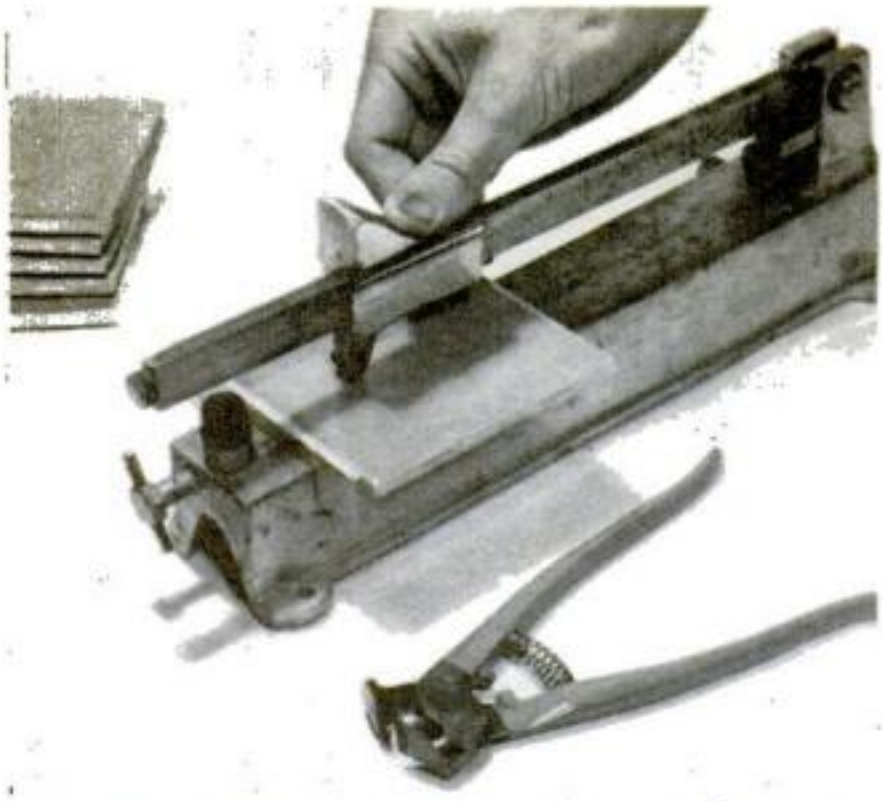
ready to spread. You apply them with a notched trowel or spreader, which comes free from many tile dealers—or for less than a dollar at any hardware store. The size and spacing of the notches are important because they control the amount of adhesive you apply. If you are putting tile over concrete or mortar, there will be some wear on the applicator edge; you may have to file the notches deeper.

Be careful not to lay down too much adhesive—it may ooze up between the tiles.

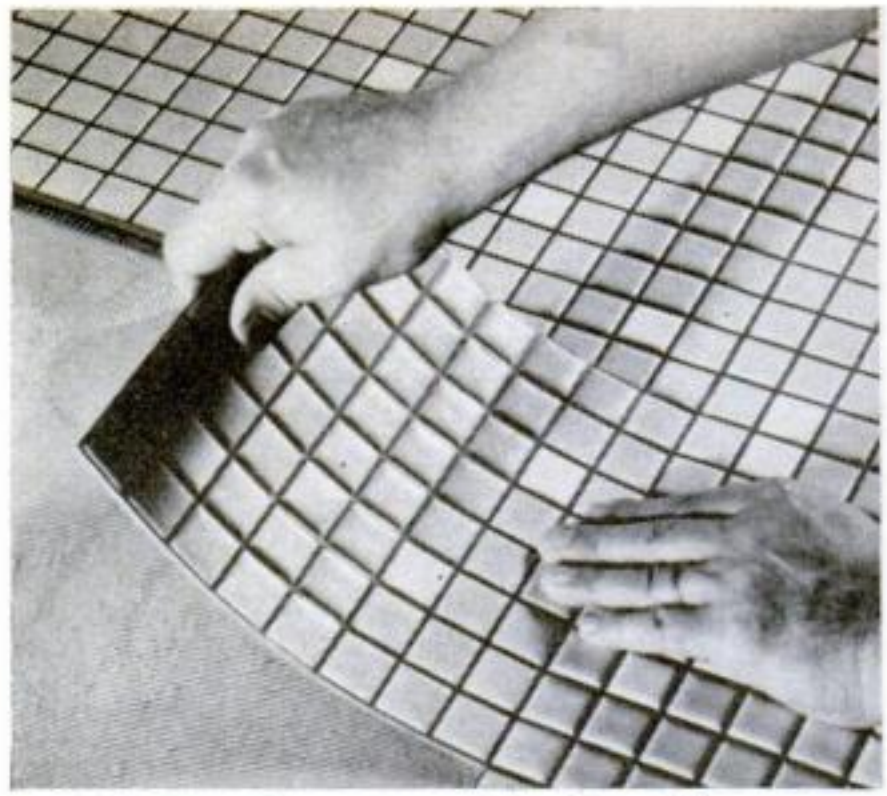
CONTINUED

2 **Placing tile** is a simple matter of pressing them gently into mastic. Tiles shown have spacers on edges. If yours don't, place two sixpenny nails in space to keep them even.

3 **Easiest way to apply grout** is with rubber gloves, forcing it into cracks. Don't do it bare-handed; grout is caustic. Before grout sets, clean with dry, then damp, cloths.



Tile cutter you can rent or borrow has a jig for holding tile, plus a bar for cutter to ride on, assuring smooth, straight cut. Nippers clean up edges; they work best on small tiles.



Small floor tiles, grouted with rubber, come in square units like asphalt floor tiles, are applied to the floor in the same manner. The photo above shows how flexible they are.

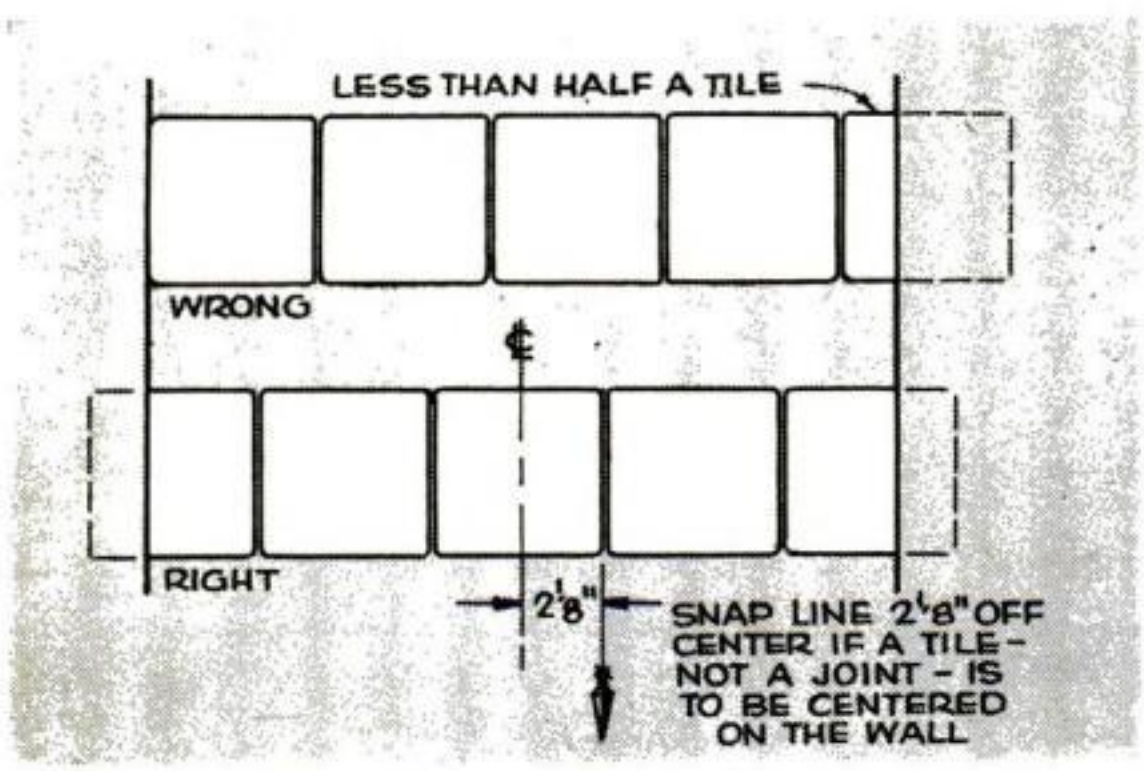
Most mastics give you an hour or two of working time. You can spread the adhesive ahead of you, with little chance that it will set up before you place the tiles. It's best to let the mastic set for half an hour before you place tiles on a wall. This pretty much eliminates the chance that they might settle downward.

Placing the tiles. Actual placing of the tiles is easy. Just press them into the mastic. The few tricks you ought to know involve planning and layout.

First, vertical courses should be absolutely true and plumb. Use a level or a plumb bob to be sure. One exception: It is often better to follow an existing vertical (window or door jamb, or a corner in the wall) even if it happens to be a little out of true. Use your judgment; avoid wedge shapes you'd get by staying plumb alongside a feature that is a little crooked.

Second, plan the lateral spacing of any tile larger than about an inch square. Find the center of the area. Then, using a tile as a scribe, mark off the number of tiles you'll need to reach a corner or an edge. If the last piece turns out to be less than half a tile, start at the center with the middle of a tile. However, it may be that your own judgment would dictate starting at a corner with a full tile if the opposite corner happens to be inconspicuous–back of a door, for instance.

Certain features cannot be altered. You want a row of full tiles along the edge of a bathtub. This dictates the break at floor and ceiling. Also, it creates a situation in which you may be laying tile from the top



Center tiles on wall to avoid unbalanced look indicated by top row in sketch. The small piece of tile is unsightly and structurally unsound. Do this:

1. Find the center of wall.
2. Using a tile, mark off number needed to corner.
3. If you end up with less than half a tile in corner, start with a full tile centered on center line. If you end with more than half a tile, start with joint at center line. This will give widest possible symmetrical fragments at walls.
4. Snap a plumb line at the wall center or 2⅛" off center to keep tiles plumb and true.

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down. Many experts run the course along the top of the tub, and if it is not enclosed at both ends, extend the course into the corner. Then they lay below the course and above it. If you do this, you may find it simplest to nail up a temporary straightedge, level with the tub, and lay the course along the straightedge. Later, remove it and run the tiles down to the floor.

Lateral and vertical spacing is not so critical with tiny mosaics as it is with larger tiles. Some of the foot-square sheets are composed of tiles as small as ⅜". Fitting them in tight spots is a simple matter of snipping off as many rows as you need.

Cutting tiles. Ceramic tiles have a glazed surface over a pottery-like base. If you score the glazed surface, the tile will break on the score mark. An easy way to make sure of this is to score the tile, then lay it over a piece of coat-hanger wire and apply pressure on both sides of the wire.

You can handle a few tiles with a glass cutter. However, a tile cutter (nippers) makes the job simple. You can rent one. Many outlets, including mail-order houses, will lend you one if you buy their tiles.

Porcelain tiles are harder—fired all the way through—uniform in density and color. They are harder to break cleanly. Score them the same way, and use the wire trick. But you'll find nippers almost essential. They exert extreme pressure on both sides and set up a fracture line that is usually pretty straight. Use the nippers for the small tiles. They break clean.

An absolutely clean break is not critical, so long as the visible edge is smooth. If necessary, you can grind it smooth with a coarse carborundum stone.

Grouting is the last step. Ceramic tiles are deliberately spaced about $\frac{1}{16}$" apart—sometimes more when the tiles are large. This space is filled with a cement-like material called grout—after the tiles are in place and the mastic has set somewhat. You'll find instructions on the package in which the grout comes.

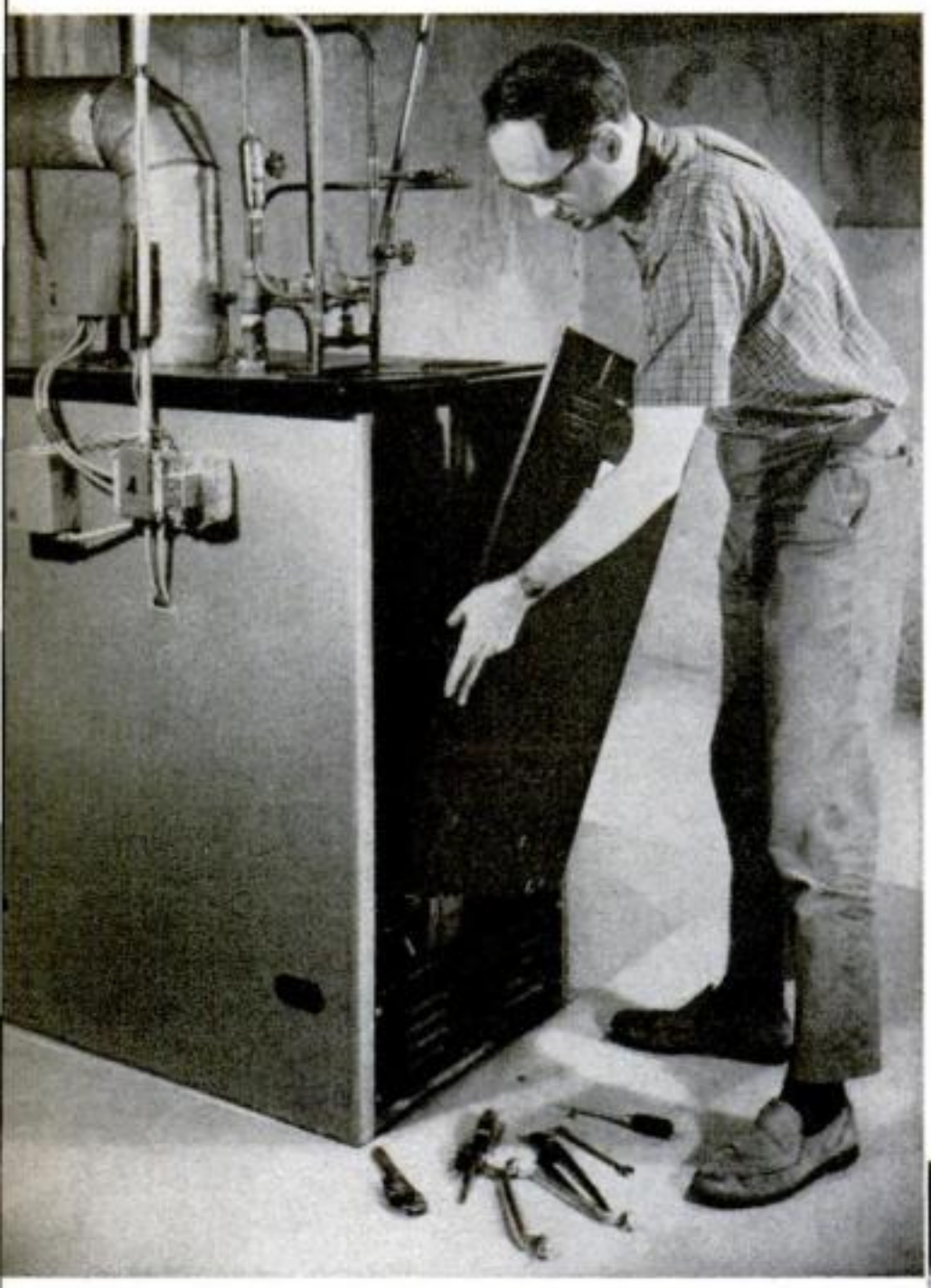
Some additional tips:

- Make sure that you work the grout into every crack, filling it to the bottom, for the best job.
- Before the grout dries and sets too

[*Continued on page 194*]

Mosaics range through all the colors and in size from ⅜" to 1". At right are five of the scores of patterns that are available. They are mounted on a wire mesh in 12" squares. The pebble style fits together without sign of a joint.

How to Save up to 25% on



Installing new firebox liner involves opening the furnace, vacuuming up the soot, changing burner nozzle to a smaller size.

IF YOU'RE sick of paying big bills for fuel oil every winter, you'll be relieved to know that there is a thoroughly tested way to cut your fuel costs as much as 25 percent. The key to this remarkable saving is a new ceramic-fiber board used in a firebox-liner kit that you can install in your furnace yourself.

Developed to shield astronauts from extreme temperatures during orbital flight, the new material is made from aluminum silicate fibers that have high insulating ability and can take a 2,300-degree blast of heat.

In your furnace, the material will immediately start to glow from the heat. This makes the flame so hot that it will burn all the fuel oil completely. There's no soot, no odor, no wasted oil. The combustion is so efficient that you have to reduce the amount of fuel oil going into the furnace by putting a smaller size nozzle on your oil burner.

The fiber liner does other things, too.

To assemble the new liner, cut hole for the

A new firebox liner that you can install yourself will help your furnace run at top efficiency. Work time: less than an hour. Cost: about $14

By John Ingersoll and Charles E. Rhine

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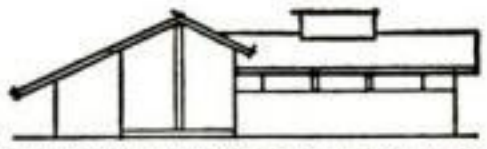
Your Fuel-Oil Bill



It makes your furnace quieter. Since the material is soft, combustion sounds are absorbed in the same way acoustical ceiling tile blots up room noises. Also, you can forget about firebox repair bills; the material will last as long as your furnace.

The new firebox-liner kit is put out by Johns-Manville and it contains everything you need to install it in your home furnace. The liner material is called Cera Form. It looks and feels like beaverboard.

Will it work in your furnace? The best sign that it will is if you've seen a rise in your oil bill. This can mean that your firebox needs repair. You can tell by checking for excessive odor, soot, and noise while the furnace is running. Switch off the furnace and check the firebox for deterioration—cracks, spalled firebrick, soot buildup. You can put in a new ceramic-fiber liner for a lot less than repairing a heavy firebrick liner or replacing a cast-ceramic one.

The new liner will work wonders in an old coal furnace that's been converted to oil. It will also improve combustion in just about any hard-brick-lined chamber, in many one-piece refractory chambers and large steel chambers, and in any old firebox that's too big—and most of them are.

You can tell whether or not your combustion chamber is too big by measuring the area of the firebox floor. If the area is greater than 75 square inches for each gallon-per-hour firing rate of the burner nozzle, you'll get greater efficiency with a Cera Form liner. The firing rate is stamped on each nozzle, and you'll be able to see it when you remove your nozzle.

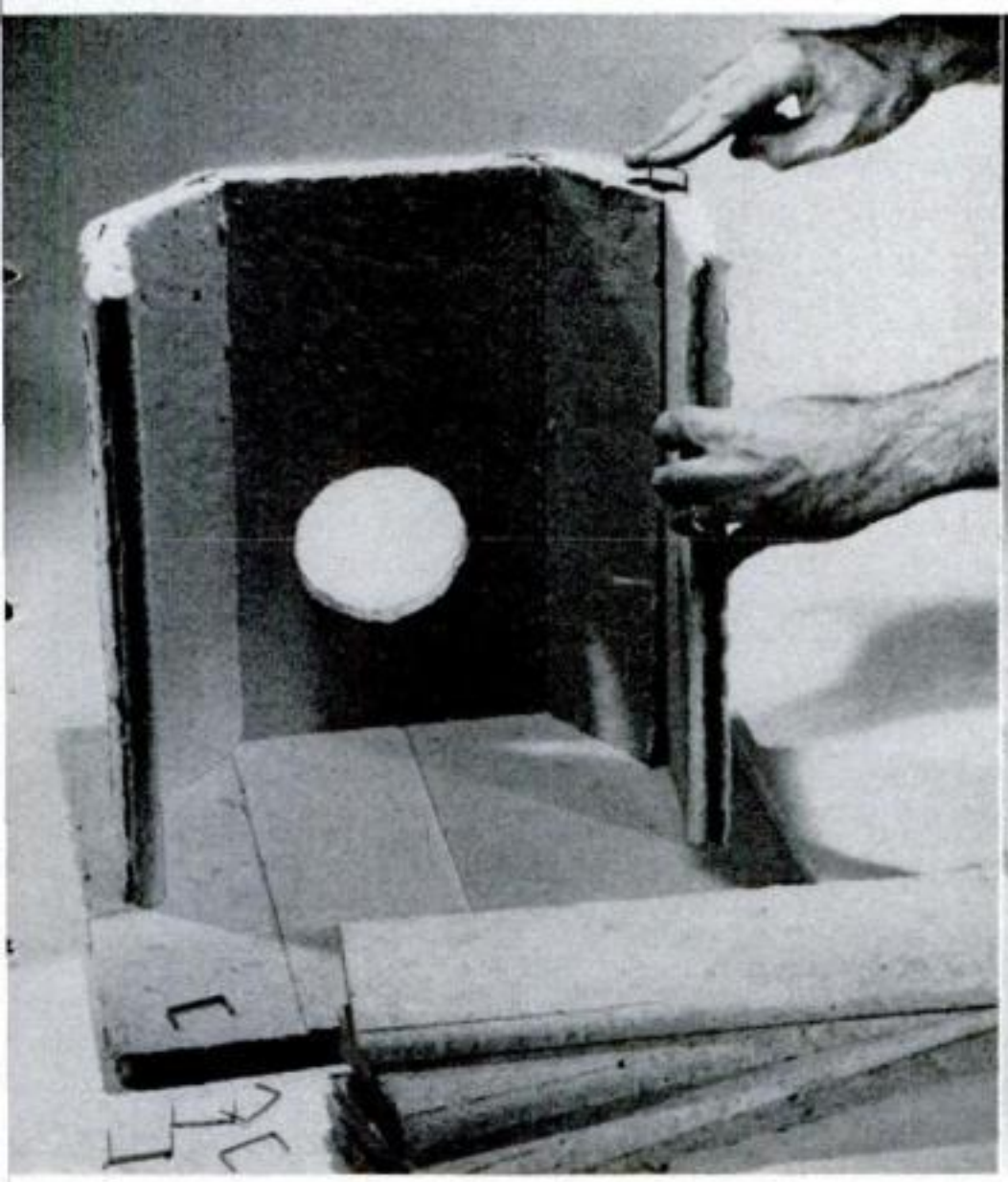
The ceramic-fiber panels won't work as well in some of the newer furnaces, since many units produced since 1963 already have ceramic-fiber liners. Also, it shouldn't be used in a furnace with a horizontal stainless-steel chamber.

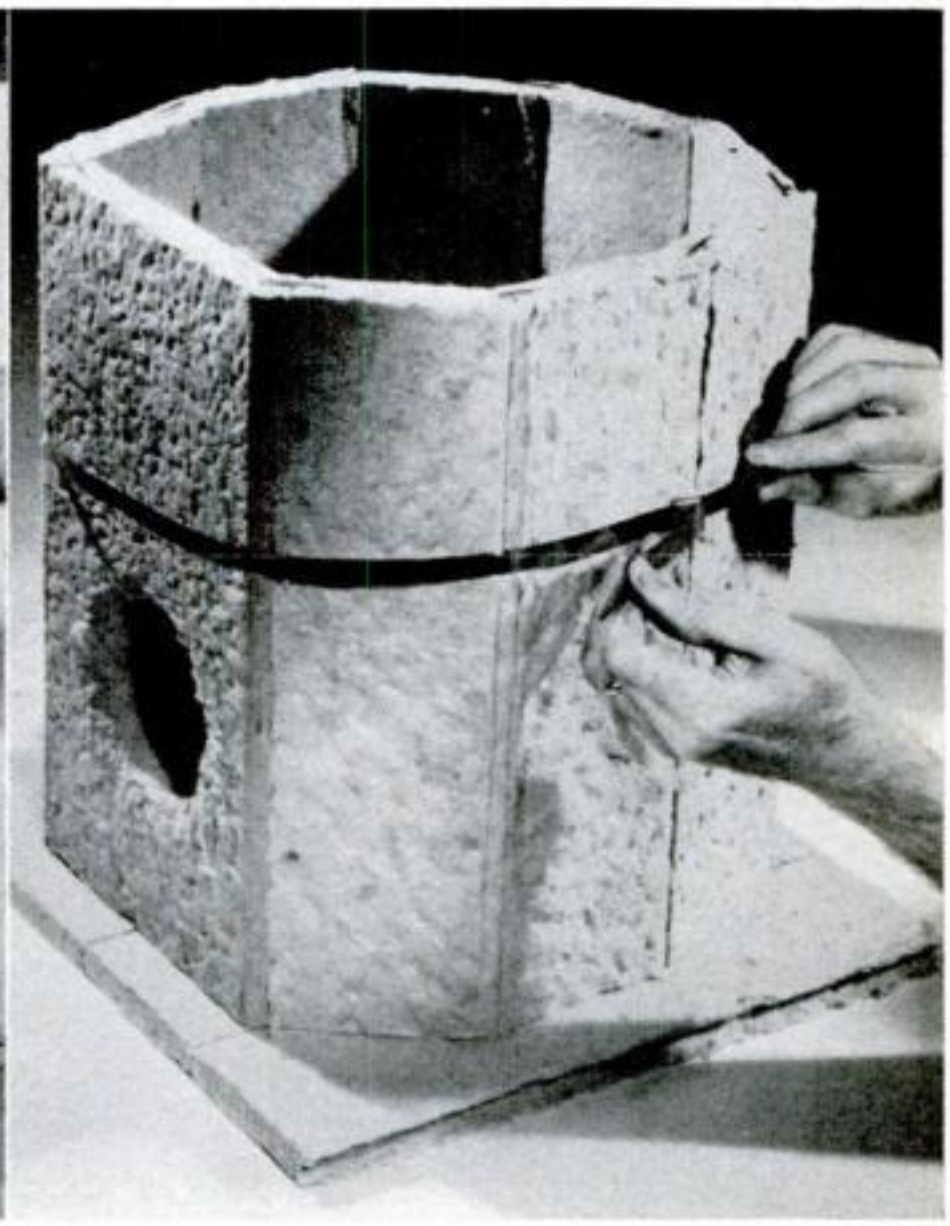
Installing the liner. If you don't want to fuss with it yourself, just ask your oil-burner serviceman to put one in.

If you want to save money by doing it

CONTINUED

blast tube, lay down the floor panels, tie the wall panels together with staples and strap.





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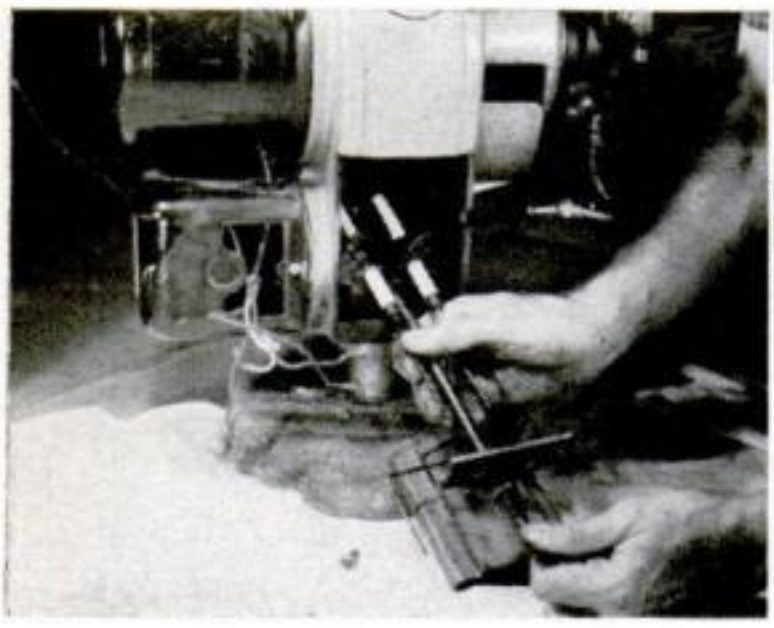
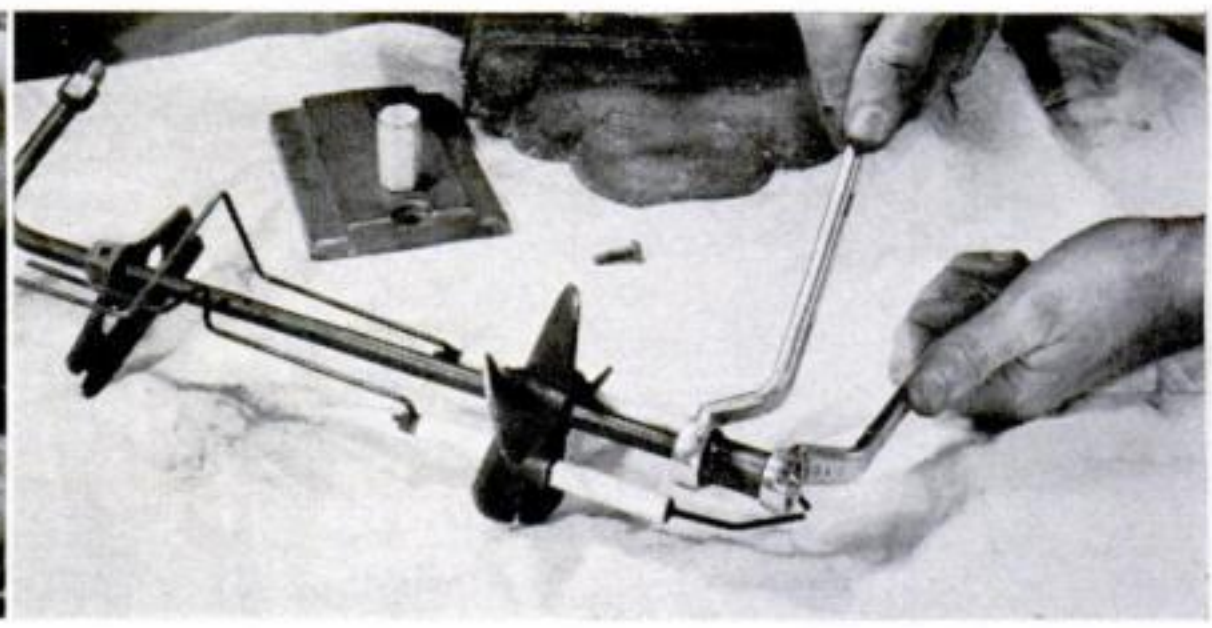
How to select and put in the right nozzle for the liner

What size ceramic-fiber firebox liner do you need for your furnace? It depends on the gallon-per-hour rate of your present oil-burner nozzle (table at right). You'll find g.p.h. rate and firing angle stamped on the nozzle, as at left. With your new liner, use a nozzle that has a 60- to 80-degree firing angle and a g.p.h. rate two sizes lower than your present nozzle's. To remove the nozzle-electrode unit from burner and change nozzle, see below.

CHOOSING THE RIGHT LINER

NOZZLE SIZE (g.p.h.)	RECOMMENDED DIAMETER OF CHAMBER
.50– .85	10"
1.00–1.25	11"
1.35–1.50	12"
1.65–1.75	13"





yourself, you can order a Cera Form combustion-chamber kit directly from the manufacturer. For prices, write Sabastian Bonet, Johns-Manville Corp., Manville, N.J., specifying the gallon-per-hour (g.p.h.) rate of your present oil-burner nozzle. The kits are also available from dealers; just look in the yellow pages of your telephone book under "Oil Burners—Supplies and Parts" to find a dealer near you. The kits contain ceramic-fiber panels (the number varies with the size of the chamber ordered) which are assembled as shown in photos.

Before you start, it's a good idea to have the operating and servicing booklets for both your oil burner and your furnace. These will have instructions for disassembly and cleaning. If you don't have them, write to the manufacturers. You should find their addresses on the brand-name tags.

First step is to wire-brush and vacuum as much soot from the furnace as you can find. Don't use a home-type vacuum cleaner. Use a shop vac or rent one. Unhitch

Use this check list to cut your fuel-oil bill

To get top efficiency from your oil-fired heating system, make sure your serviceman takes care of all these points:

Test efficiency. At 50 to 75 percent efficiency, the unit needs overhaul. Tops is 80 percent; 75 percent is good. Check again after overhaul.

Clean out furnace. Vacuum all soot from furnace and stack. This should be done each season.

Inspect baffles. Does the unit have enough baffles—if any?

Inspect burner nozzle. Nozzle size should match firebox diameter (see table above).

Flush fuel strainer. Dislodged dirt from the fuel strainer can clog the fuel-nozzle orifice.

Install firebox liner. Put in a new ceramic-fiber combustion-chamber liner as described in this article.

Seal air leaks. No air should reach the firebox except through the burner blower.

Clean oil filter. If there is no filter in the line between the tank and burner, install one.

Install draft stabilizer. If you have no draft stablizer, you'll lose too much heat up the chimney.

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the stack pipe and clean it. Clean as far up the chimney as you can reach.

Check to see if the chamber floor is level and even. If necessary, level it with furnace cement. Use the cement to seal any air leaks around the base of the furnace.

The Cera Form floor panels are simply put down on the chamber floor and fitted together without fasteners. The panels go groove against tongue with the smooth side towards the flame.

Cut a hole the diameter of the oil burner blast tube in the wide front panel provided with the kit. Measure the height of the hole from the top of the floor panels. It's easy to cut the hole with a hacksaw blade. Chamfer the back (rough side) of the hole so that the blast tube will fit snugly and extend flush with the inside of the chamber.

The side panels are set up and are held together by staples, which you push in by finger pressure. They are then tied together with a stainless-steel band provided.

How do you change the burner nozzle? The size of the Cera Form liner you put in your furnace is determined from the chart according to the g.p.h. firing rate of your *present* burner nozzle. But, since the liner gives faster heating and better combustion, you can replace the nozzle with one that is two sizes smaller.

The firing rate of the nozzle, in gallons per hour, is stamped in the metal on the side of the nozzle. You'll also find the nozzle firing angle there. This tells, in degrees of arc, the angle at which the oil sprays out of the nozzle.

The nozzle sizes listed in the table (facing page) are those available with 60- to 80-degree firing angles. You must use a nozzle with a firing angle in this range to prevent the fuel oil from squirting onto the chamber walls.

For your new ceramic-fiber liner, use the chart to select a nozzle with a g.p.h. rate two sizes lower than your present one. But if your present nozzle is .85, you obviously would go only one size lower to .50. If you find that the smaller nozzle does not put out enough heat for your house, use another, one size larger.

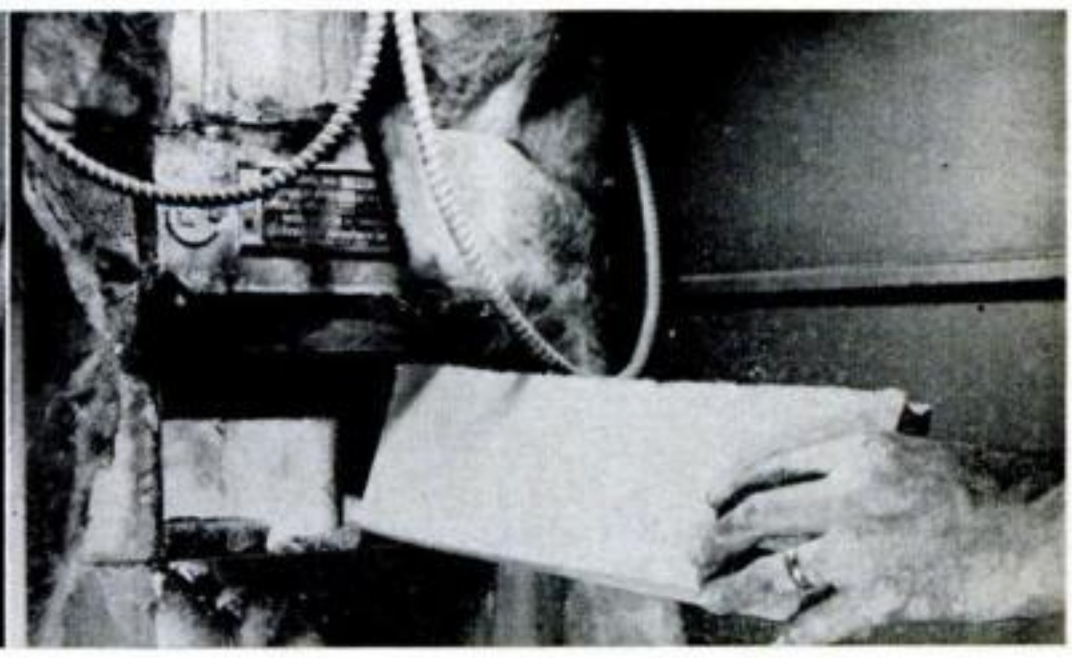
It's easy to change the nozzle yourself—your oil-burner manual will show how. Usually, it just involves removing the back plate on the burner, unsnapping the transformer leads, and unbolting the nozzle-electrode unit. It will come out if pulled straight back. The nozzle has normal right-hand threads; the adapter, left-hand threads.

Avoid getting the slightest bit of dirt on the new nozzle when you install it.

The smaller-capacity nozzle squirts less fuel oil into the furnace, so less air is needed for combustion. Adjust the air intake by loosening the choke ring around the blower housing and turning it so the intake holes are smaller. Reduce the air intake until there is no smoke or odor from the flame. Before making the final adjustment, however, you will have to let the furnace run for 30 minutes to an hour since the new liner will give off smoke for a while.

Your new ceramic-fiber liner will give you an immediate increase in furnace efficiency. But follow the check list for cutting down fuel-oil bills and you may be able to save even more money. ■ ■

Open the furnace by unbolting the faceplate. Be sure to flip off the emergency switch and shut off the fuel-oil supply. Clean inside of the furnace and level the chamber floor.



Assemble the panels inside the furnace. Quarters may be cramped in some furnaces, but the liner is so easy to put together that you can do it with one hand if necessary.

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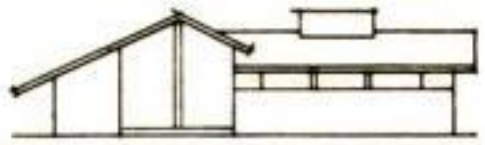

Close look at exposed-aggregate paving shows how the stones and pebbles are embedded in concrete. In the landscaped entrance walk at the right, close-packed river pebbles were tamped into the concrete. The white pebbles offer a pleasant effect against dark concrete.

Try Pebble-Faced Paving

It's easy. Choose one of three methods—for full paving, or stepping-stones in your yard

By Bob Gilmore

STONE-and-pebble paving is a great favorite with landscape designers these days. It's easy to see why. The stones give it a more natural appearance and it blends in with the plantings around your yard. Yet, despite its artistic look, it is simple to put down—an obvious do-it-yourself job.

You can make an exposed-aggregate surface in three ways:

1. You pour the slab in the normal way. After the concrete has begun to set, you wash away the top cement, leaving the stones and pebbles exposed.

2. You pour the slab in the normal way, but you then press stones and pebbles into the surface by hand.

3. You cast paving slabs upside down, arranging stones in the bottom of the form and then filling it with your mix.

All of these methods are easier and require less skill than standard steel-troweled concrete, where the object is to get a smooth, unblemished surface.

Most often, exposed-aggregate paving is laid in fairly small sections and the forms are left in place as decoration. This makes the job simple, since it means you handle relatively small batches of mix and you can work at your own pace. Use cedar, cypress, redwood, or one of the other long-life woods, and be sure also to soak the form boards thoroughly with a wood preservative.

If you know a local ready-mix outfit that uses natural gravel, you can use their concrete; if it's made of crushed stone, however, the exposed aggregate is usually not as attractive. Many home owners have

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for New Beauty Underfoot

found it best to mix their own, using sand and gravel that will produce a good-looking surface.

Once poured, the cement should be tamped to impact it against the forms and the earth; it should not be troweled or floated. This tends to bring up too many "fines" and to sink the coarser aggregate you want near the surface. It is enough to run the screed board (a length of two-by-four on edge) along the forms to be sure the pour is smooth, level, and without hollow spots. A slight sawing motion with the screed not only helps level the concrete, but also provides about the right action to produce a good surface.

Remember: Basically, the less you work the surface, the more coarse material you will find on top when you finish.

The wash-away method. Start washing the cement as soon as it has dulled over completely. On a cool, calm, damp, cloudy day, this may take several hours. If it's hot and dry and windy, the first cement you pour may be dulled over before you pour the rest. Don't wash too soon or you may swish away too much binding cement. If you wait too long, you may find it necessary to loosen the surface with a broom.

The purpose of the washing is to loosen the cement right at the surface, so it will rinse away, leaving unbonded sand. Most of this sand must be swept away after the pour

CONTINUED

Wood forms are sometimes left in place in a pebble-faced walk. Cedar, cypress, redwood can be used. Soak forms in wood preservative.

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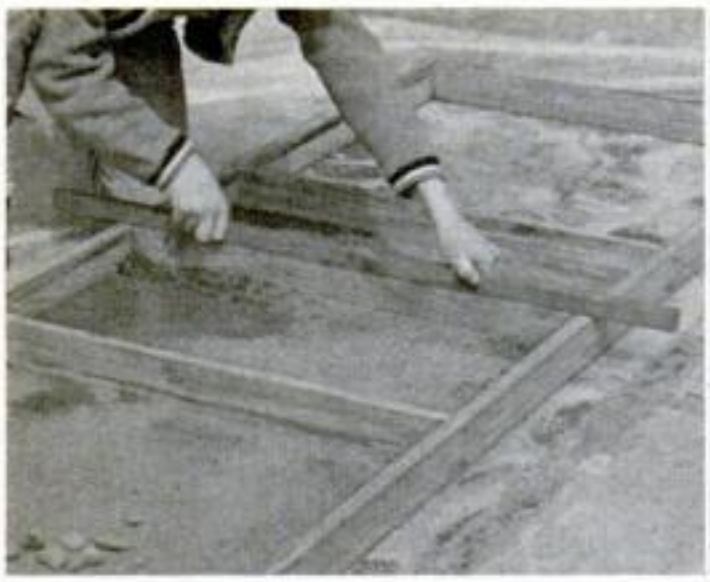
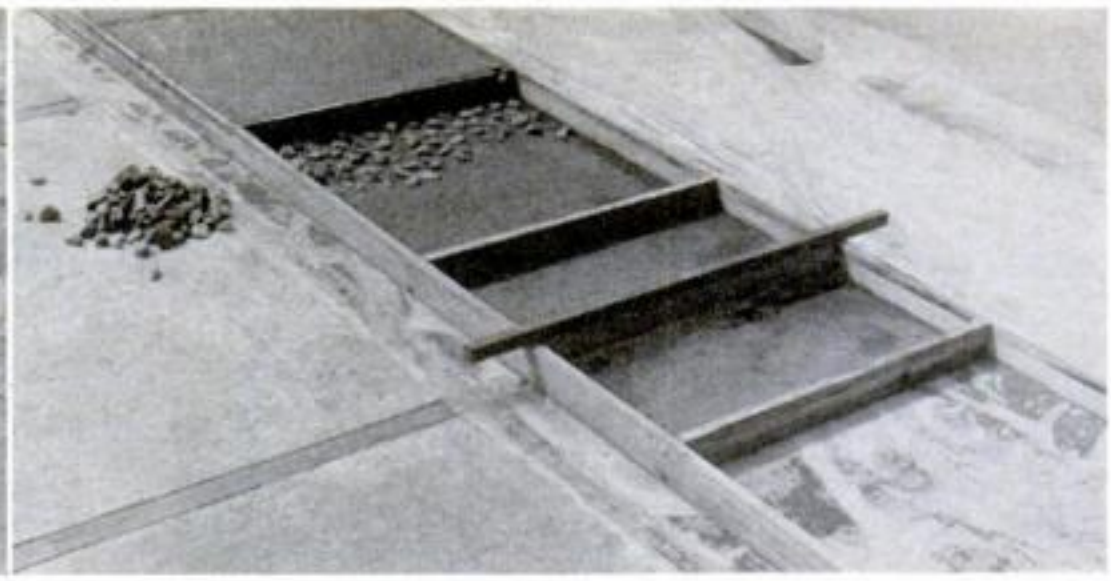
How to cast pebble-faced stepping-stones by upside-down method





Pebble-faced stepping-stones can be cast as shown here. Spread ⅛" to ¼" of fine sand as above within the form. Then arrange, on the sand, the pebbles or minerals you want to show. Spray-dampen the stones, fill the forms with concrete, and let it cure for seven days.

Flop the flagstones after the concrete has set, wash away the loose sand, and you have a set of paving rectangles (or squares or circles), studded with your selected pebbles. Stone at right in photo shows result of hasty dumping of concrete into form—all pebbles are shoved out to edges, leaving center barren.

is hard. If you attempt to sluice it off the "green" cement, you will dislodge some of the stones you want to keep.

As with any concrete paving, you must keep the washed aggregate surface damp for a few days to ensure good hardening. Covering it with plastic sheet is a good way to do this. Lift the sheet now and then to spray additional moisture beneath it.

Placing stones by hand. If you use the technique of placing choice stones in the poured concrete, you carry the process forward through the screeding stage. Then, before the concrete dulls, place your selected stones. Depress them until just the top stands above the surface. Tapping each stone gently with your finger helps bond the stones to the cement. It may be necessary to spray the stones after they are placed, to clean them.

Since you can see what you are doing with the stones when you place them this way, you can turn your imagination loose. Interesting effects have been produced by using stones, pieces of tile, colored glass, and other materials to create a mosaic effect.

The upside-down way. Exposed-aggregate rectangles, squares, disks, or other shapes small enough to handle as stepping-stones can be made this way:

Within 2½"-high forms laid on a flat surface, spread ⅛" to ¼" of fine sand. On the sand—carefully, so as not to disturb its smoothness—spread the stones or mineral chunks whose faces you want to show. Tamp them into the sand with the palm of your hand—again with care to avoid shifting them or the sand. Dampen with a fine mist that can't wash the sand away.

Then carefully shovel-place concrete to fill the forms. (Dumping it from a barrow will dislodge both stones and sand.) Strike off any excess and cover for curing. After seven days, remove the forms, flop the slabs, and wash away the loose sand to reveal the aggregate.

Want it colored? For color in addition to textural pattern in exposed-aggregate concrete, do one or a combination of these three things:

Add concrete- or stucco-coloring powder to the mixing batch; set colorful stones in plain concrete; or set colorful stones in contrastingly colored concrete. ■ ■

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Idaho Falls
Kimberly
Meridian
Malad
Marsing
Menan
Mt. Home
Nampa
Payette
Pocatello
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what's new in PHOTOGRAPHY

The Amazing Flashcube
—and a new line of Instamatics

PUT four flashbulbs on one base inside a 1⅛-inch plastic cube and you have Sylvania's new Flashcube. Design a camera into which you merely pop a Flashcube to be ready for flash photography, and you have Kodak's new line of Instamatics. Put the two together and you have today's simplest combination for taking pictures.

The bulbs are little wonders. They're AG-½s—half the volume of standard AG-1s. Each has its own reflector (center drawing). The four reflectors are actually one sheet of pressure-molded aluminized plastic.

To utilize the Flashcube, Kodak has redesigned its Instamatic line. Six new Instamatics (at $18 to $125) plus two 35mm cameras ($95 and $115) offer a revolving turret that turns 90 degrees after each shot, as the film is advanced, to set a new bulb in place.—*Everett H. Ortner.*

Spring motor on model 154 powers a whole cartridge on one winding. Motor automatically turns films to No. 1 shot on loading, advances film and rotates 'cube 90 degrees after each shot.

Top of the line model 804 has pull-tape spring motor, coupled rangefinder, adjustable diaphragm and shutter, electric-eye exposure. A viewfinder light signals when flash is needed.

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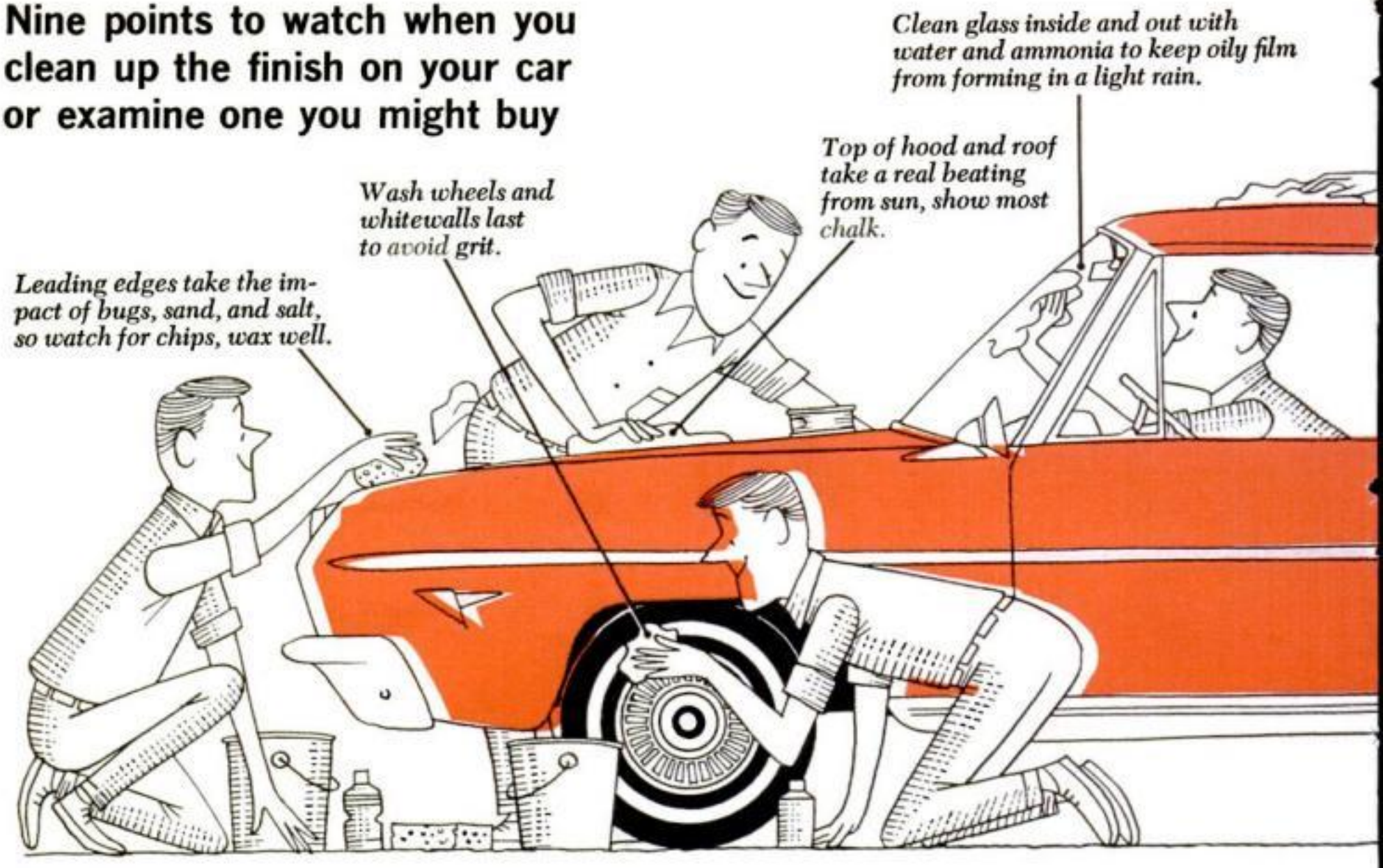
Nine points to watch when you clean up the finish on your car or examine one you might buy


Clean glass inside and out with water and ammonia to keep oily film from forming in a light rain.
Top of hood and roof take a real beating from sun, show most chalk.
Wash wheels and whitewalls last to avoid grit.
Leading edges take the impact of bugs, sand, and salt, so watch for chips, wax well.

How to Keep Your

By E. D. Fales Jr.

DESPITE today's "miracle" auto finishes, you can't simply let the rain wash your car and expect it to look its best or to retain top trade-in value. For the satisfaction of driving a clean car, you'll have to work at shining it up and keeping it that way.

There is no magical system of car care, but there are a number of new products that help you lick today's tougher problems of keeping your car clean. You may not realize it, but you are driving more and driving faster than ever before. At turnpike speeds, so much sand, grit, and often salt hit the paint finish on your car that leading edges chip and wear down faster. Hitting a hard-shelled beetle at 70 m.p.h. not only nicks the paint, but also applies a shot of highly corrosive bug juice to the chip.

Even more damaging than high-speed abrasion is the effect of air-pollution fallout. After a light rain or heavy dew, you've probably noticed a layer of black dirt that won't wipe off. This is a combination of smoke, salts, tars, acids, and plastic fumes that combine to form industrial smog. Add hydrocarbon deposits from engine exhausts and diesel smoke, mix with water, let dry on the paint—and you're headed for paint deterioration in as little as a week.

Car makers have given you a big assist with the new paints, like the acrylic lacquers used on all GM cars since 1961 and the still newer acrylic enamels that better Ford lines, Chrysler, and American Motors have applied since 1963. The right kind of polishing can bring these back to showroom shine even after three years.

But what they haven't told you is that the new paints do require regular washing and regular maintenance. At first car makers thought the new paints could take care of themselves, that just a quick hosing would give you the equivalent of a wax

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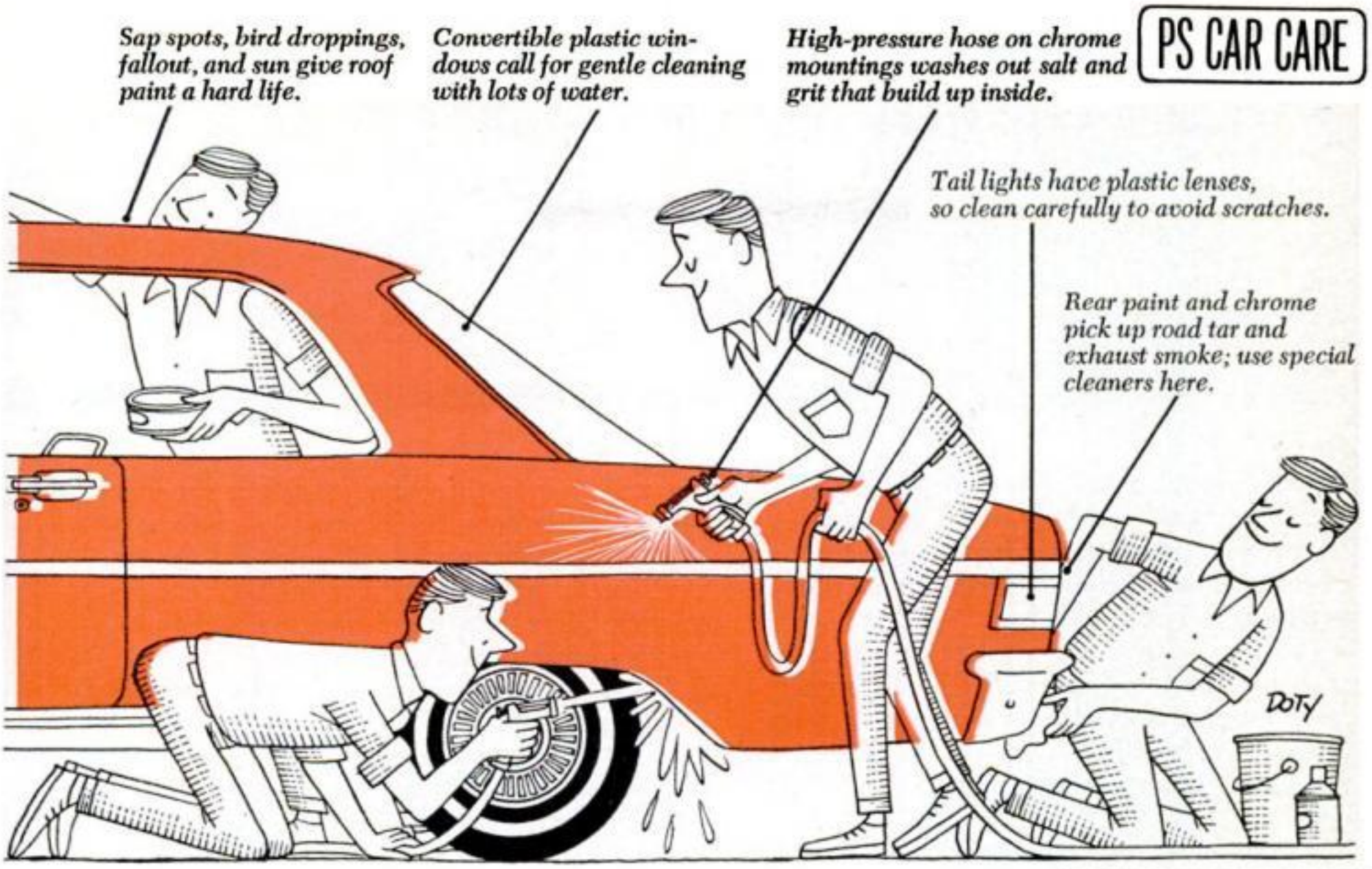
PS CAR CARE
Sap spots, bird droppings, fallout, and sun give roof paint a hard life.
Convertible plastic windows call for gentle cleaning with lots of water.
High-pressure hose on chrome mountings washes out salt and grit that build up inside.
Tail lights have plastic lenses, so clean carefully to avoid scratches.
Rear paint and chrome pick up road tar and exhaust smoke; use special cleaners here.
DOTY

ILLUSTRATED BY ROY DOTY

Car Looking New

job. Nice thought, but it just didn't work out. Now all major makers recommend waxing, and protect their new cars with special coatings, even for the short trip from factory to dealer.

Your manual says never to wash the car when it's hot or in the sun. That's a good policy, frequently violated by auto laundries, which take your car right off the hot street, spritz it with live steam, and follow up with a detergent scrubbing.

Car cleaning is not simple, but it is necessary. Here are six pointers for taking care of your car finish.

1. Wash, wash, wash! Your car needs a weekly bath if there is any fallout film you can feel. Use a mild car-washing detergent—not your wife's stronger household variety.

In very dirty industrial areas where your car sits out, chemists recommend a quick hose-down every morning in addition to the weekly wash job. "Dry wash" cloths seem to work well on dust, but less well on gummy fallout deposits.

2. Best ways to wash. A weekly trip through an auto laundry is probably the easiest and one of the best ways to keep your car looking new. These places have developed the right combination of detergents, cleaners, and techniques for the water and dirt in your area.

But, at $1.50 per wash—$78 a year—you might want to consider using a self-service car wash if there is one available. Here you should also get the right combination of cleaners and water, but the kind of a job you get depends on the work you put into it yourself. The cost is much less, about 25 to 50 cents a wash job.

Or, if you decide to go this far, how about doing it all yourself? Getting a really good wash job at home is not difficult. The basic rule is to work fast, work in the shade, use a mild detergent, and keep the whole car wet. Go from the top

CONTINUED

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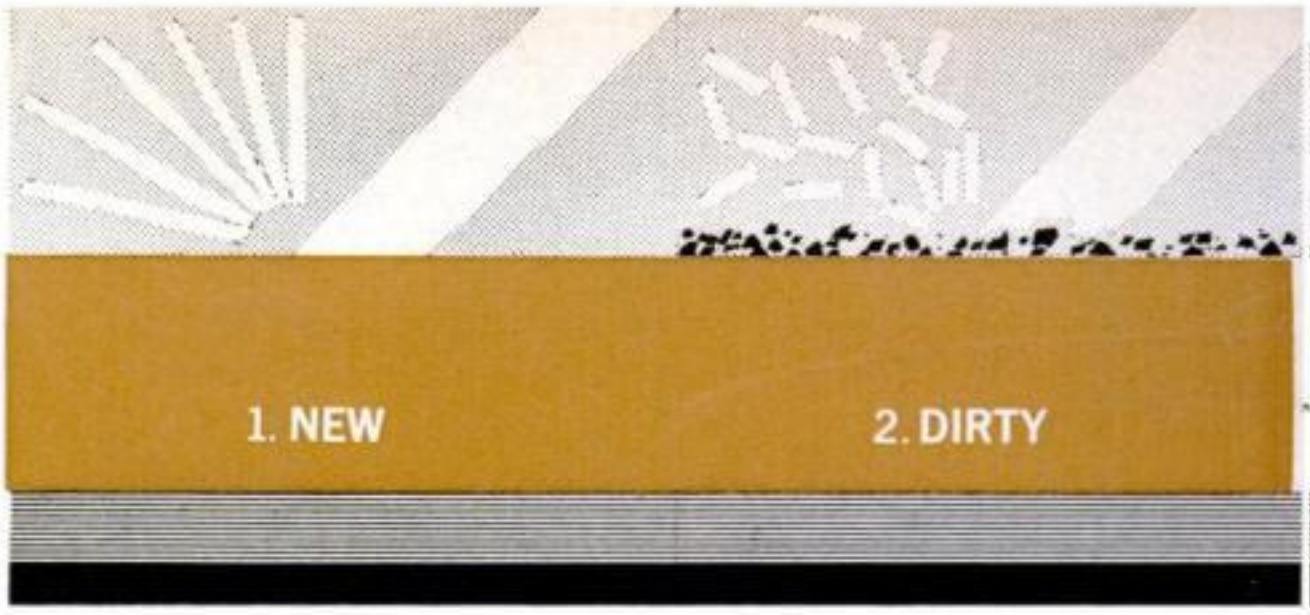
What happens to the finish on your car as it ages

New paint (1) reflects light from a smooth surface, so it looks deep and glowing. Dirt (2) on new paint breaks up light, makes it look dull. Older, chalked paint (3) is no longer smooth, looks dull. Polishing (4) smooths down the chalked surface and restores some shine, but it takes a coat of wax (5) to fill in the imperfections for a like-new appearance.



down. Avoid streaks on lower areas by working fast and following up with a chamois or damp bath towel to dry the car.

How about the combined wash-and-wax products? The idea that the dirt washes off while the wax is deposited on the finish is a bit hard to comprehend. But microphotographs show that it works. These products are called "combos" in the trade, and are certainly worth a try.

3. Clean your car regularly. Like cutting the grass, you can't put off car cleaning and still have a sharp-looking car. One way to keep track of your wash jobs is to post a schedule in your garage or carport. Mark it when you do the job.

4. Use cleaning compounds. Despite faithful washing, the finish will eventually build up a layer of traffic film. The only way to remove this is to clean the car with a car-cleaning compound. Remember, however: *Wax each time you clean, clean each time you wax.*

Car-cleaning compounds come as liquids and pastes. Both are mixtures of mild abrasives and chemical solvents. Many contain silicones. (Silicones will not make repainting the car difficult, because you can now add "silicone dope" to paints to get good results.)

The pastes usually contain more abrasives and the liquids more of the active chemical cleaners. Active solvents in liquid cleaners may damage the paint if you pour them directly on the car and let them stand.

It pays to get a known brand of car cleaner because slack labeling laws make it possible for a fly-by-night maker to sell one with a solvent so strong it could take off your car paint.

Start any car-cleaning job by hosing off the grit. Clean the car in two-foot squares. Pour cleaner on a folded pad of cloth and apply it to one square of paint while the next one dries. Keep turning the cloth as it soils. Use lots of cleaner. Polish with another cloth. And then wax.

For good finishes that are slightly soiled, consider one of the combination cleaner/waxes. They work well if underlying paint still shows some gloss.

For deteriorating or badly chalked paint, wash with a detergent, try a cleaner, and be prepared to use rubbing compound if the cleaner doesn't bring up the shine. White (light-duty) compound is the mildest. If it does not give you a clean job, try orange (medium). For a real dog, use dark orange (heavy duty). Rub until the finish is clean. If the paint is all dead chalk, take it easy; don't rub it all off. Mostly you'll be able to see the shine come up while there is plenty of color, but if you note darker primer color along ridges, go easy.

Should you use a power buffer or electric drill with a bonnet on it to polish your car? Not unless you really know what you're doing. It is very easy to burn through the finish, and there is a real shock hazard. One way to electrocute yourself is to wash a car, stand in the puddles of wash water and use an ungrounded electric buffer.

5. Wax twice a year. Many experts claim you should wax even new cars that have superpaints. Acrylic lacquers can be waxed when you get the car. Standard enamels, still commonly used on lower-priced models and foreign cars, need about 90 days to cure before waxing. Acrylic enamels do better if you wait the 90 days even though the manual says you can wax them at once.

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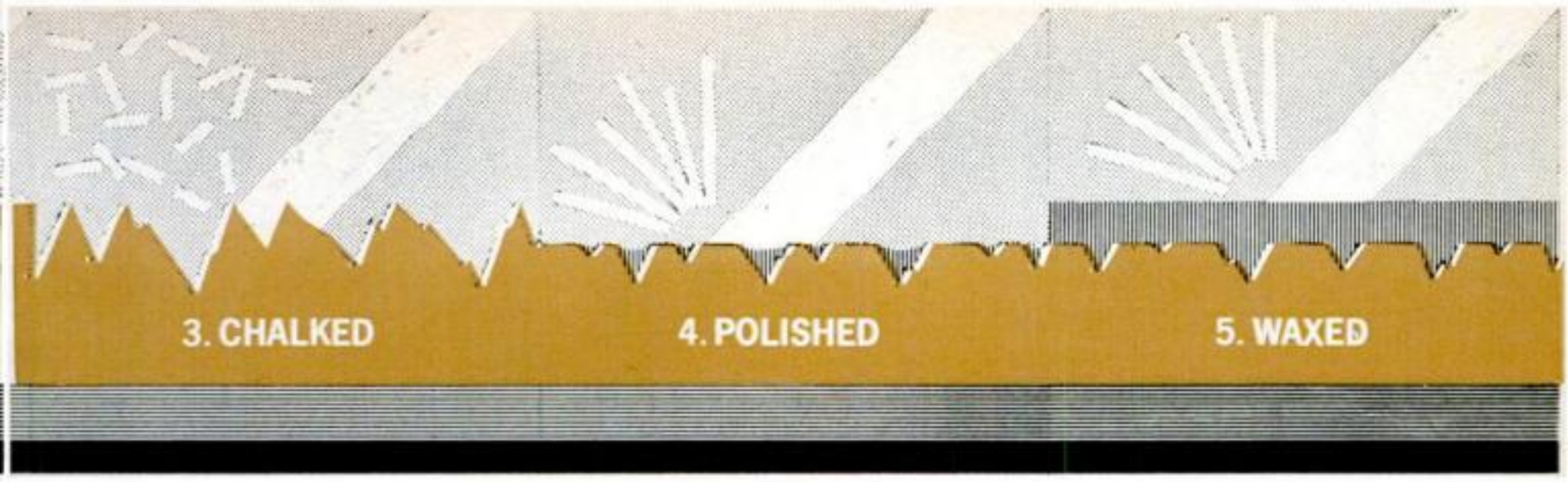

For older cars, wax spring and fall if the car leads a sheltered life—more often if it stands out in polluted air. As long as rainwater beads on the finish, you have wax left, but when it goes flat, the wax will have worn off.

6. Kinds of waxes. Paint makers say that all the well-known waxes are good, whether natural or synthetic. You have a choice among pastes, liquids, and aerosol sprays. All give you a final coat about 7/1,000 inch thick. For a lasting finish with any type, the important thing is to rub it hard. This is what hardens it. Putting on extra coats does not work; you just can't pile wax any thicker than that 7/1,000 inch.

Other car-keeping tips. Keep your car clean by not letting it get dirty. When possible, avoid freshly tarred or heavily salted roads. Don't follow closely behind a sand truck, even if there's a tarp over the load; flying sand can abrade your finish.

Care in parking helps, too. At a factory, park on the up-wind side if possible to avoid fallout. Pick the shady side of buildings and schools. Avoid trees that drop sap or are full of birds.

The reward for your care will be a better-looking car while you drive it, and a better price for it when you trade. ■ ■

WHAT IT TAKES TO KEEP YOUR CAR LOOKING NEW

PRODUCT	WHAT IT DOES	HOW TO USE IT
PLAIN WATER	Rinses off grit	Hose down clean car weekly or twice weekly
WATER PLUS MILD DETERGENT	Cleans mildly dirty car kept outside	Rinse with plain water; sponge on detergent solution; rinse off
CLEANER	Removes heavy soil and cleans up mildly chalked paint. Comes in paste, liquid, aerosol	Apply with cloth and rub finish clean every 4 to 6 months. Always wax after cleaning
RUBBING COMPOUND	Mild abrasive smooths chalked finish. White, light orange, and orange for mild, medium, and severe paint dulling	Rub on with cloth pad after using cleaner if cleaner leaves car looking dull. Use mildest grade that brings up shine
POLISH	Cleaner plus oily silicone additive cleans and leaves a temporary shine on finish	Rub on with cloth pad and wipe off remaining haze. Use after wash if you haven't time for more thorough cleaning and waxing on good finish
COMBO	This cleaner plus polish or wax does really float off dirt and leave wax on paint, chemists say	Use for weekly wash on clean car in place of water and mild detergent. Follow directions on label
WAX	Liquid or pastes of natural (petroleum) or synthetic (silicone) waxes protect clean finishes for about 6 months	Rub on cleaned car finish, using cloth pad; then hand-polish hard. Polishing gives wax its shine and makes it last
ENGINE CLEANER	Spray cans or liquids emulsify oils on engine and turn them to soap that hoses off	Coat warm engine after putting plastic bags over air intake, oil filler, distributor. Let soak for 15 minutes; hose off. Use twice yearly
CHROME CLEANER	Chemical and abrasive action removes dirt and corrosion	Wash chrome once or twice weekly with water or water and detergent. Use chrome cleaners with care to avoid scratching. Wax no help; it penetrates finish, doesn't stay on surface
WHITEWALL CLEANERS	Removes scuff marks from white sidewalls	Use with brush and gloves only when mild detergent won't clean dirty whitewalls. Take care; some, highly alkaline, will etch finish on fenders and wheels

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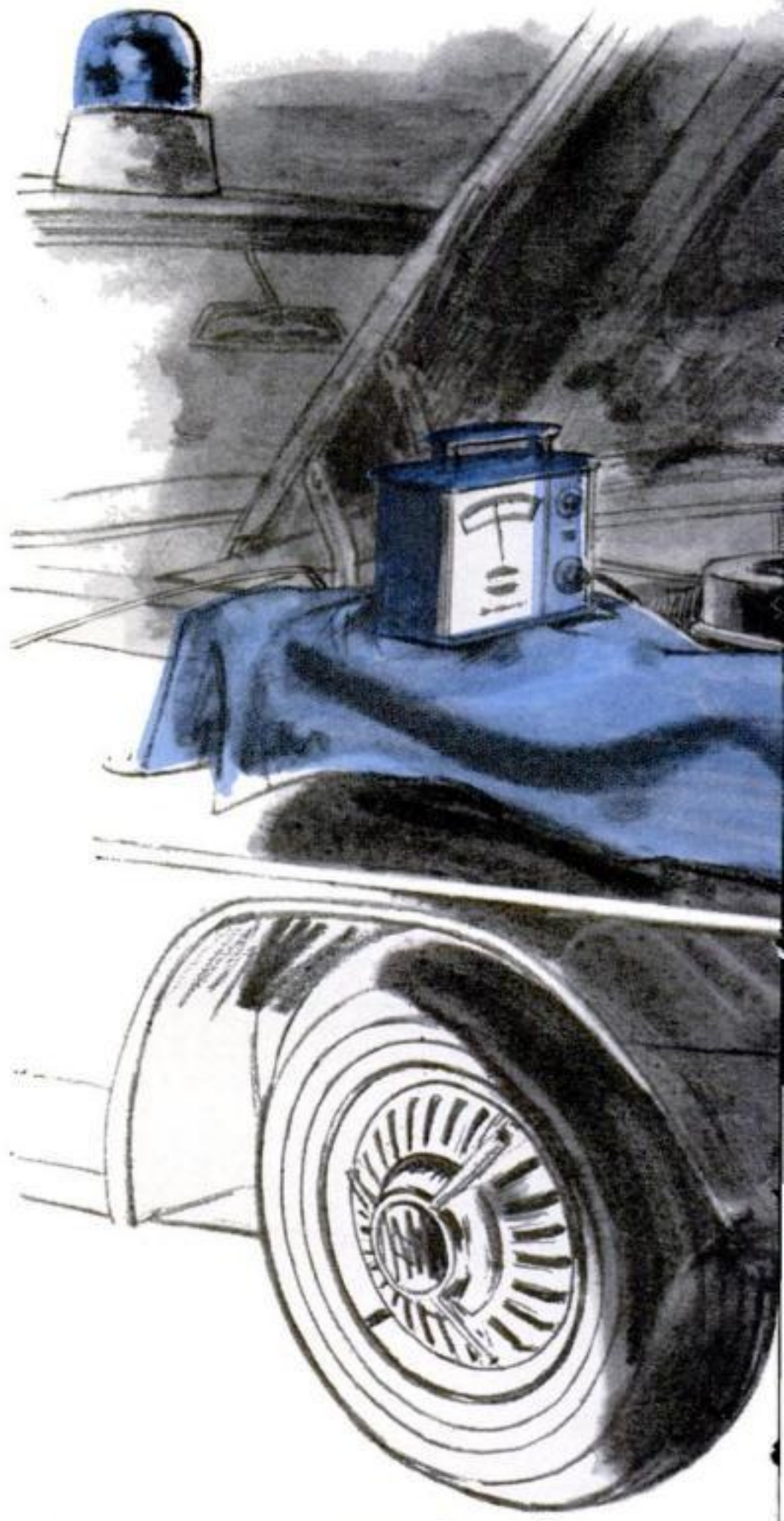
Gus Cracks a Case for

Was the suspect's sedan hot enough to run away and hide from a patrol car? If not, the cops had the wrong man

By Martin Bunn



POURING himself a cup of coffee in the Model Garage office, Gus Wilson looked up to see a familiar lanky figure in the doorway.

"Morning, Sam. Have some coffee?"

Chief of Police Sam Eldon, whose heavy-lidded eyes and sagging jowls gave him the look of a sleepy hound dog, folded his length lazily into a chair.

"Can't do more than poison me," he said, taking the cup Gus handed him.

"Poison? We're more likely to be bored to death, Sam. It's been a quiet summer."

"Till last night," returned Eldon. "About four a.m. the Benton Electronics alarm system went off. It's wired to the station house, so we were there in three minutes—just in time to see a Ford sedan hightail it out of there.

"With Carnahan driving, we took off after it. He's good, but the other fellow was better. Held 90 all the way to Grover's Creek, then hit over 100 until we lost him on some curves. But I spotted the car as we shot past the fork at Route 117.

"When he saw he couldn't lose us, he must have decided to put on an act. He wasn't doing more than 50 when we pulled him over. Then he started to act as if he didn't know what it was all about."

Gus set down his cup. "Reminds me of last night's late show. The chase scene was good but the ending was a flop."

"This show isn't over yet," said Eldon. "There was no loot in the car—the alarm must have scared him off before he got down to business. But we did find a nice set of tools. He's a hard-looking character, name of Burke. Says he's a mill mechanic and that he was driving all night to get to a job in Granton by morning.

"He also says a car zipped past him just before he reached the 117 fork. I phoned the Granton mill this morning. The people there never heard of him. And those tools of his could jimmy a door or bust open a cheap safe as easily as they could be used on mill machinery."

Gus stood up. "Well, now that you've beat about the bush, what did you come for? Want me to look over his car?"

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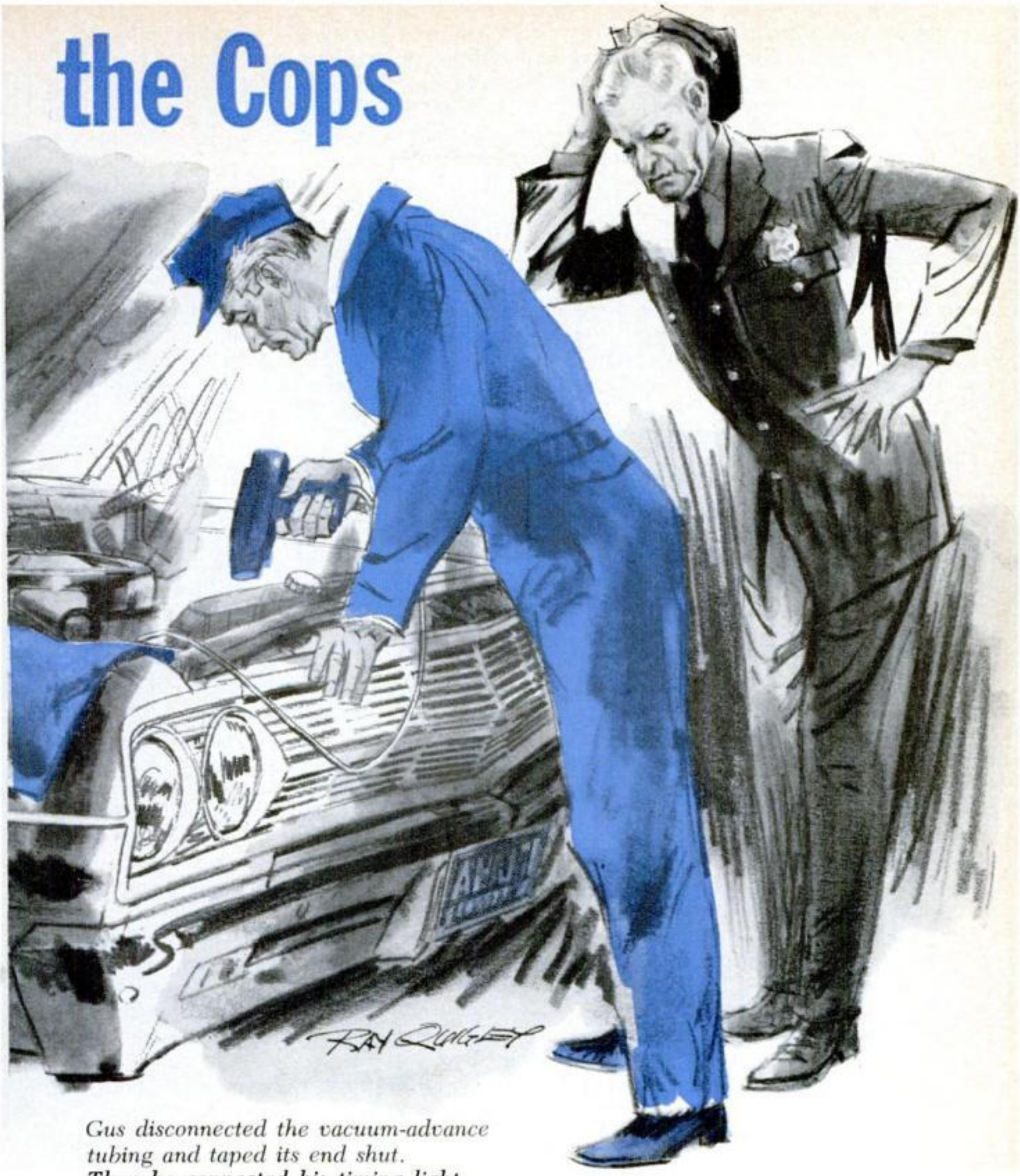
the Cops



Gus disconnected the vacuum-advance tubing and taped its end shut.
Then he connected his timing light.

"No, not *his* car," said Eldon. "Mine. One of my boys tuned it last week, and it sure did fine last night. But this morning when I was doing only 60 it began to knock, and power fell off."

Opening the hood of Chief Eldon's well-groomed Chevrolet V-8, Gus figured that the man who had timed it had probably left the distributor loose. It took him only a moment to find he was wrong; the distributor was securely tightened. The spark knock Eldon described could hardly be from carbon deposits; Gus himself had ground the valves and cleaned out carbon six weeks before. The plugs showed no signs of overheating, the fan belt was tight, and the radiator well filled.

But a stuck manifold heat valve could cause local overheating that wouldn't show

CONTINUED

Urheberrechtlich geschütztes Material

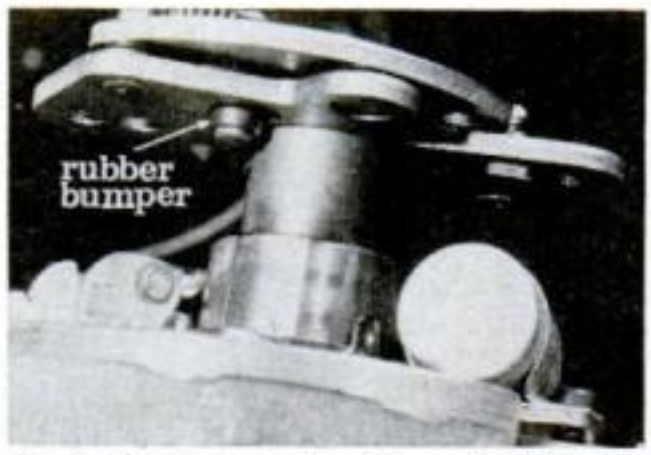
on the dash. Gus checked the valve. It was free, and stood in the heat-off position normal for a warm engine.

Getting out his electronic plug checker, Gus hooked up its four leads and switched on the engine. As he opened the throttle to take voltage readings at high compression, there came the unmistakable, metallic rattle of a spark knock.

The eight traces on the scope all showed firing voltage to be in the normal range. No plug gaps were worn wide, nor were any of the plugs fouled. Gus unhooked the scope, disconnected the vacuum-advance tubing from the distributor and taped its end shut. Then he connected his timing light and a tachometer.

At idle, the indicator stood at six degrees before top dead center. Gus opened the engine up to 1,600 r.p.m. The centrifugal advance moved the timing up to nine degrees. At 2,300 r.p.m., it shot up to more than 18 degrees.

"Too much spark advance at high speed," said Gus, shutting off the engine. "Could be the spark-advance springs have gotten weak."



A stop pin, moving in a slot, limits the advance of the breaker plate in Delco distributors. The rubber sleeve or bumper on the pin is meant to eliminate possible rattles. But if the rubber fitting falls off, the pin permits spark advance beyond the manufacturer's specifications.
Photo courtesy Champion Spark Plug

"All of a sudden, since five a.m.?"

Gus grinned. "I'll admit springs don't usually weaken so fast unless they're overheated. This is where gadgets quit and we start thinking. So the first thing I'll look for is a little rubber bumper."

Mystified, Eldon watched Gus remove the distributor and take it to a bench. Turning up the breaker plate, Gus looked at the stop pin.

Eldon leaned over the bench. "I don't see any bumper," he said.

"Because it isn't there." Peering into the casing, Gus fished out a small rubber fitting. "Here it is. It softened through wear and fell off the stop pin—maybe your high-speed chase helped shake it off. Without it, the stop pin was smaller and let the breaker plate advance several degrees more before the pin hit the slot edge. As the car was already tuned for maximum high-performance advance, this was too much of a good thing. You got pre-ignition, a spark knock, and a drop in power. I'll put on a new bumper and then check out the timing."

Fifteen minutes later the police car was buttoned up and ready to go.

"Suppose you think you're pretty hot," growled Eldon, with a wink at Gus's assistant, Stan Hicks.

"There has to be somebody around to set an example for you public servants," said Gus cheerfully.

"Well, you've given me an idea," confessed Eldon. "About checking out this suspect's car. We have to book him in 24 hours or let him go. It's an old trick to use an ordinary-looking car with a real hot engine in it. You show me that's the case, and I'll charge him."

"Didn't get his license number at the scene of the crime, did you?" asked Gus.

"No," said Eldon. "But we saw him scrape a fender in tearing out of the alley. This car has the marks—of course the suspect says they were made somewhere else, two days ago. Come on, get in and let's go."

In the courtyard of the station house stood a three-year-old Ford sedan. The body had been well cared for, right down to the chrome. The engine also showed signs of care. Its block was remarkably clean, oil and radiator coolant clear. But two plugs were newer and of a different brand than the rest. The carburetor and ignition system were standard. Gus could find no sign of a special head or other high-performance parts.

That didn't prove they weren't there, or that the standard engine wasn't well tuned and capable of hot performance. Gus inspected the battery posts, the coil, and the two wires that ran from its low-voltage terminals.

"Can we start it up?" he asked Eldon.

The chief nodded to a patrolman, who had brought the keys. He fired up the engine. It settled to a fast idle.

With his handkerchief, Gus pulled off one of the plug cables. Taking a wooden pencil from his pocket, he held it near the plug terminal, then brought the cable end near the other side of the pencil.

Sparks jumped, flared into tiny blue

CONTINUED

Urheberrechtlich geschütztes Material

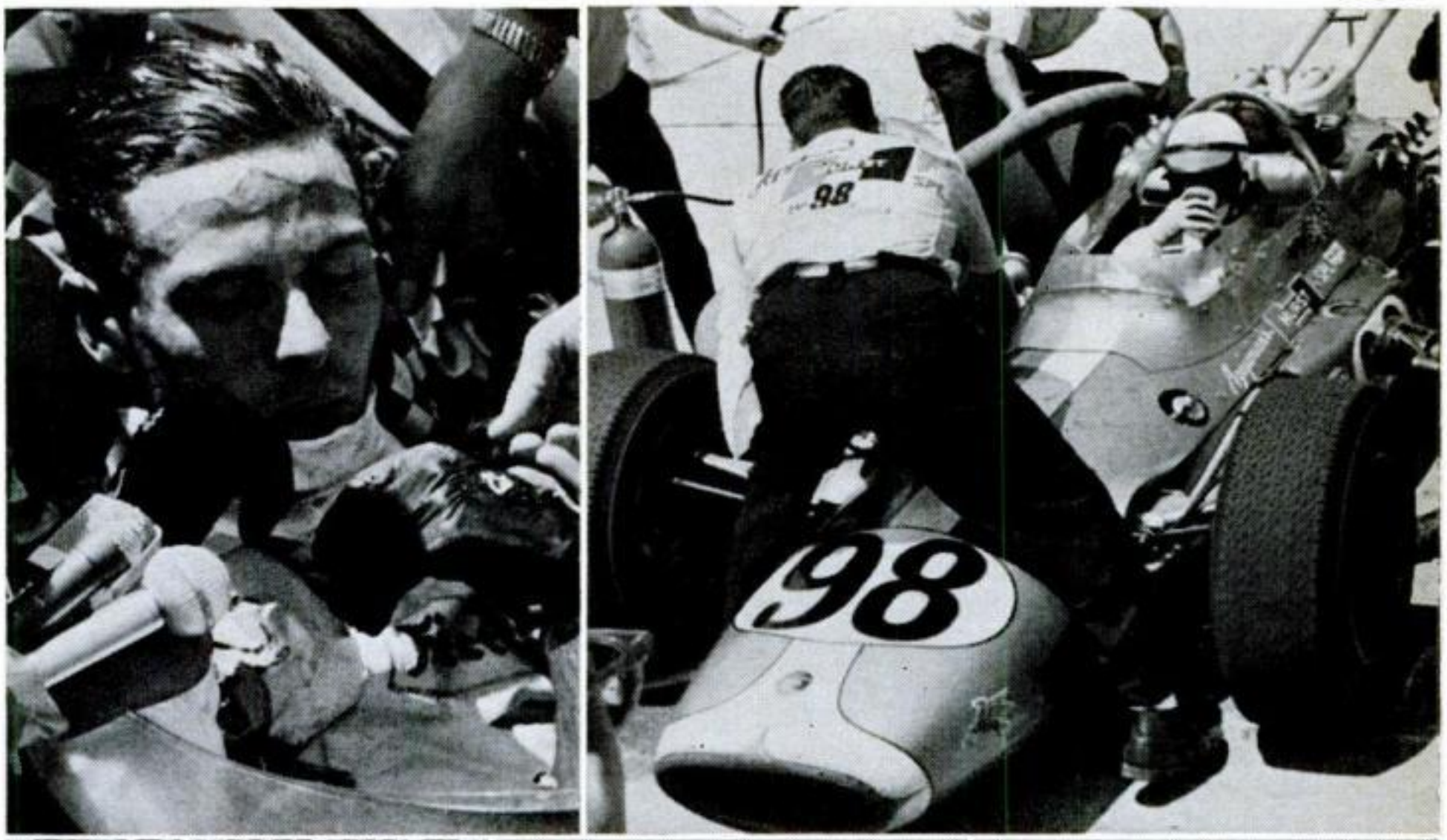
"It's about time somebody put Autolite in its place!"

First place — second place — third place — fourth place—fifth place. Where did Autolite receive its just deserts? The 1965 Indianapolis 500. Handing them out were four screaming Fords and a wailing Offy. What did it prove? That Autolite's got it—outstanding power and endurance. The first four ran with complete Autolite ignition systems. Spark plugs, batteries, distributors, coils, alternators and regulators. What's it mean to you? The same advanced engineering and quality control that went into the parts that went into Indy go into the parts that go into your car—like spark plugs with glass inner seals, nickel-chrome alloy electrodes, and hot-press shell seals. Batteries with resin-sealed covers, intercell connectors and epoxy-anchored battery plates.

AUTOLITE

RIDE WALT DISNEY'S MAGIC SKYWAY AT THE FORD MOTOR COMPANY PAVILION, NEW YORK WORLD'S FAIR

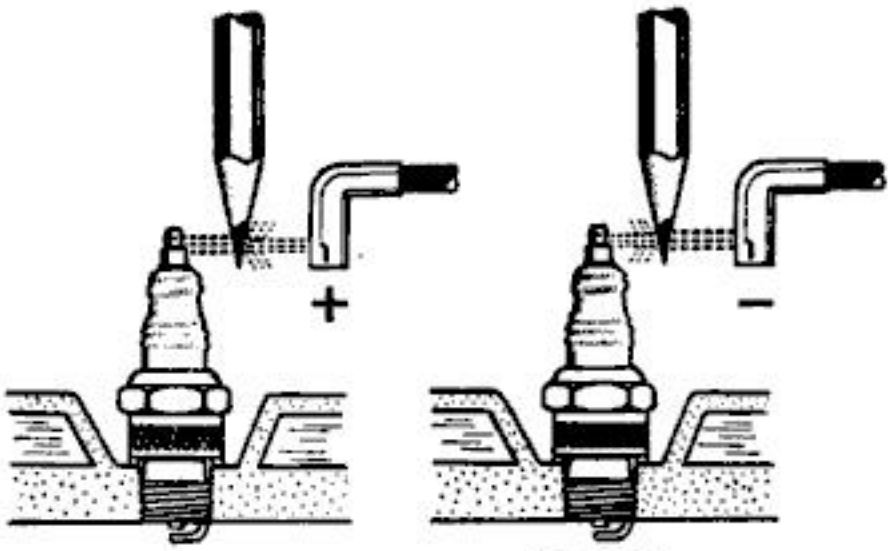
PRODUCT OF Ford



If you think that Autolite's 1-2-3-4-5 finish was an accident, take a look at the record. 8 out of 11 finishers in the '65 Indy 500 rode with Autolite. In the Daytona 500, Autolite-equipped cars took the first 15 places. The first 10 cars across the line in the Riverside 500 used Autolite. The World 600 in Charlotte was conquered by an Autolite-equipped Ford, and at the Winternationals, an Autolite-sparked Mustang nailed down the Top Factory Stock Eliminator title.* An Autolite-equipped Ford GT knocked Ferrari out of first in the Grand Touring prototype class at Sebring. Why not ride with a winner? It doesn't cost any more.

*These cars were especially equipped and modified for competition.

Urheberrechtlich geschütztes Material



A pencil proves high-voltage polarity. If feathery sparks appear on the cable side of the point (left), the polarity is wrong. Feathery traces on the plug side of the pencil are an indication that the cable polarity is correctly negative.

feathers on the cable side of the pencil graphite, and streaked across to the plug terminal. Gus stuck the pencil back into his pocket and replaced the cable.

"What was all that?" asked Eldon.

"I don't know about the man," said Gus, "but you've sure got the wrong car. This one never ran away from you at 90."

"How do you know?"

"It couldn't have," said Gus. "You couldn't push it over 75. The coil polarity is reversed. This pencil test is an easy way to show it. If the spark feathers are on the plug side of the pencil, polarity is okay. But when the feathers are on the cable side, the positive of the high voltage is connected to the center plug electrodes. That ruins performance, because it will take much more voltage to fire a plug."

"Don't see why," said Eldon. "Most cars have the negative battery post grounded, but some have the positive."

Gus grinned. "Makes no difference whether a car has negative or positive battery ground. The high-voltage polarity should always be negative at the plug terminals. It boils down to something called electron emission, on the theory that current is a flow of electrons, from the negative side to the positive.

"The hotter something is, the easier electrons can hop off it. The center electrode of a spark plug gets much hotter than the outside one, which is attached to the shell and loses heat to it. So for easiest current flow and the best spark, the hot center electrode should be negative. If you make the *outer* electrode negative, you're forcing electrons to jump off a cooler surface to a hotter one. That's like bucking one-way traffic in the Friday-night rush hour."

"The engine runs, so there must be an ignition spark," said Eldon.

"Sure, at ordinary speeds. But spark-plug engineers say it takes up to 45 percent more voltage to fire a plug with reversed polarity. That cuts down on your voltage reserve. On heavy acceleration, when compression goes up and it's harder for the spark to jump, you get misfiring. Same thing at high speeds, when the points can't stay closed long enough to build up a maximum magnetic field in the coil. Sam, this car couldn't have got away from you, let alone run for miles at over 90."

"Okay, maybe it couldn't. Now what does it take to reverse this polarity?"

Gus pointed to the coil terminals. "Just switching around these two wires."

"Maybe he switched them the wrong way while we were turning around, to give himself an out."

Gus laughed. "This engine's clean, but those terminals are caked with enough dirt to prove they haven't been loosened in months. Even if he had time to switch the wires, he couldn't have faked that. Better let the man go, Sam."

"I had a hunch I should, but I couldn't put a reason to it. Now you have. Guess that's why I put up with your bum coffee."

"Come around in the morning," said Gus. "I'll have a fresh pot on."

To his surprise, Chief Eldon did show up for coffee the next morning, looking as if he hadn't been to bed.

"Busy night, Sam?" asked Gus.

Eldon sipped the black brew morosely. "Had to check out what you said about that car, Gus, so I drove it. Began to sputter at 55, and never would hit 70. Then I switched those two wires. Made a big difference. I released Burke. He's probably wondering," concluded the chief, "why his car runs so much better."

"Too bad the real crook got away."

"Oh, we got a flash about that. A man broke into a contractor's office upstate, then walked into two patrolmen—with the loot on him—while heading for his car. Same make and model, but sassed up like for Indianapolis. Must be the one we chased—that fellow sure didn't have his ignition switched around the wrong way."

"Guess not," said Gus. "His mistake was trying to switch around other people's money." ■ ■

Urheberrecht ch geschützt Material

Open . . . drop in . . . shoot!

Kodak brings the Instamatic Camera idea to movies . . . and introduces a new era in movie enjoyment

Kodak has redesigned the movie camera. New KODAK INSTAMATIC Movie Cameras load *instantly*. Just slip the KODAPAK Movie Cartridge into the camera and shoot! No threading. No winding. No flipping. Zoom model shown, less than $160. Other KODAK INSTAMATIC Movie Cameras from less than $47.

Kodak has redesigned the movie film with 50% more picture area for better, sharper movies. The new KODAPAK Movie Cartridge is factory-loaded with improved KODACHROME II Film in the new Super 8 format —giving you 50 feet of uninterrupted shooting.

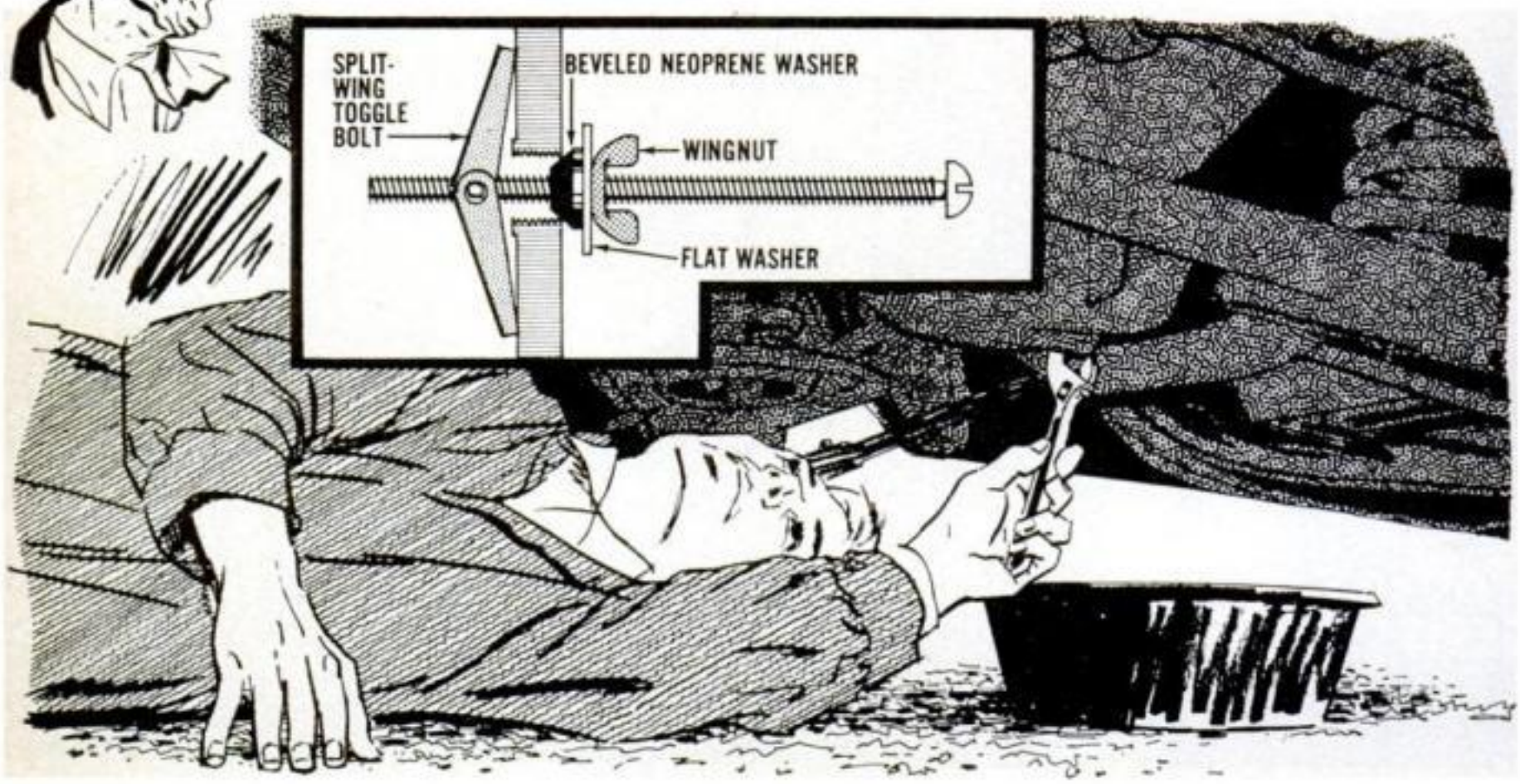
Kodak has redesigned the movie projector. The KODAK INSTAMATIC M70 Movie Projector lets you show any scene at normal, fast, or slow-motion speeds—forward and reverse. "Still" projection, too. Brilliant illumination, fully automatic threading. Less than $150. Other models are priced from less than $63.

Prices subject to change without notice.

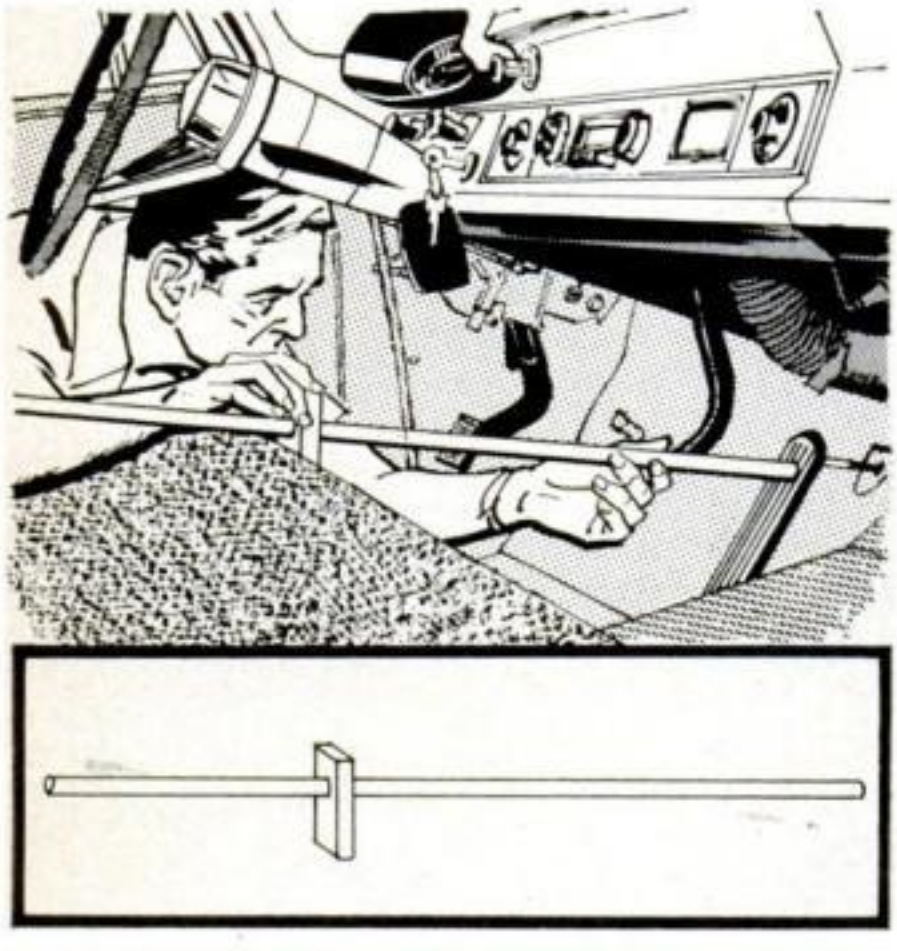
EASTMAN KODAK COMPANY, Rochester, N.Y.

Kodak
TRADEMARK

Hints from the Model Garage



Thread gone in your oil-pan plug hole? You could bore it out and tap for an oversize plug but such plugs are rarely available, and a full repair job, involving removal of the oil pan, welding in of a new nut assembly, and reassembly, would come to between $15 and $20. An inexpensive solution is to fit a $\frac{3}{16}$"-by-4" split-wing toggle bolt with a wingnut, a flat washer, and a beveled $\frac{5}{8}$" neoprene faucet washer through the hole. You then drain the oil by loosening the wingnut.



An adjustable gas-pedal hold-down, handy when checking the engine (or warming up), is easy to make. You need a $\frac{3}{4}$"-by-32" hardwood dowel and a $\frac{3}{4}$"-by-2"-by-5" block. Drill the hole in the block $\frac{1}{32}$" larger than the diameter of the dowel.

Relocating a distributor shaft after removal may be a problem. To help you replace the distributor on the correct lobe, you can dab a drop of paint, before dismantling, on top of the lobe at the spot where the rubbing block hits the lobe.

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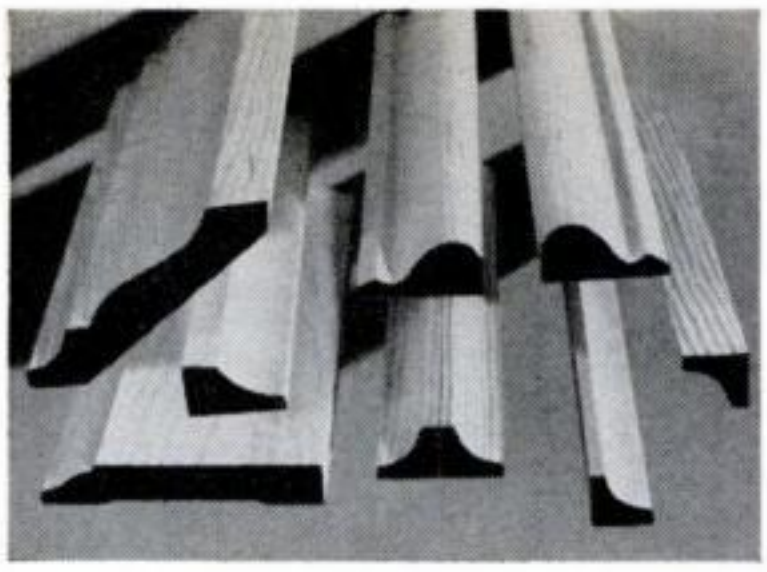
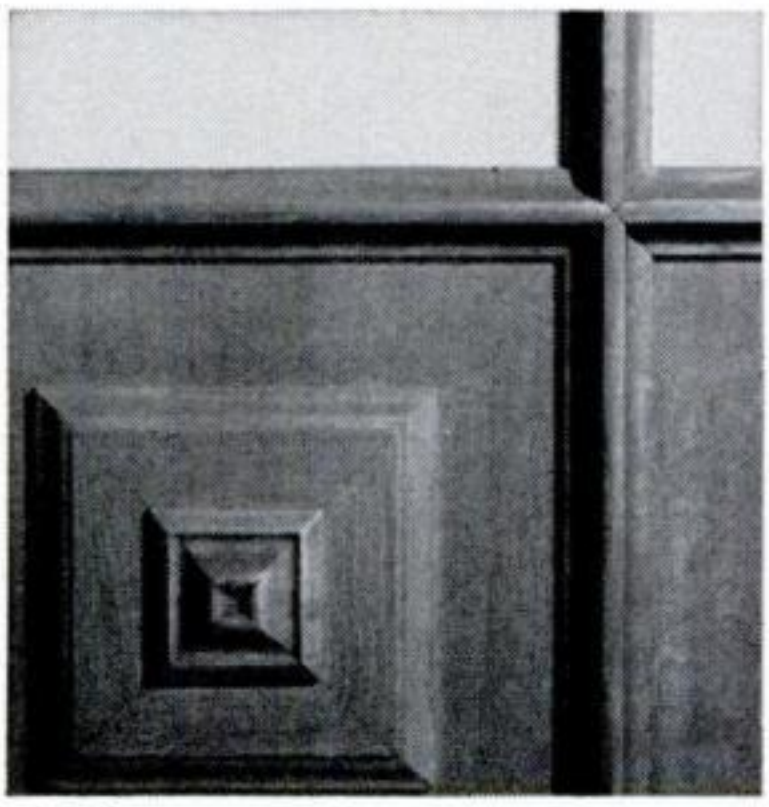
Urheberrechtlich geschütztes Material





Give a homely wall a $25 beauty treatment with Western Wood moulding.

This is going to surprise you. The only difference between this high style wall and a blank one is $25 worth of Western Wood moulding for an 8′ x 12′ wall. Remodeling with the magic of moulding is the inexpensive way to give your home the individual custom-decorated look found only in today's costliest homes.

Western Wood mouldings are easy to work, too. They're available in a variety of patterns and sizes. You can nail or glue them, paint or stain them . . . whatever your needs demand.

Our new Do-it-Yourself Book is filled with decorating tricks designed to make your home "look like a million" at very little cost. It contains easy-to-follow plans and complete material lists showing you how to give walls, flush doors, unfinished furniture and room dividers their own distinctive character. We've also put together a full-color Woodwork Idea Booklet. It's overflowing with pictures of moulding, mantels, window treatments — all kinds of woodwork ideas you can borrow for your home. Pick up your free copies at your local lumber dealer. Should he be out of them, clip out the coupon and send it along with 10c. We'll get your books to you right away so you can start performing some moulding magic of your own.

Please send me your easy-to-follow Do-it-Yourself Book on mouldings and full-color Woodwork Ideas Book. Enclosed is 10c.

Name _____

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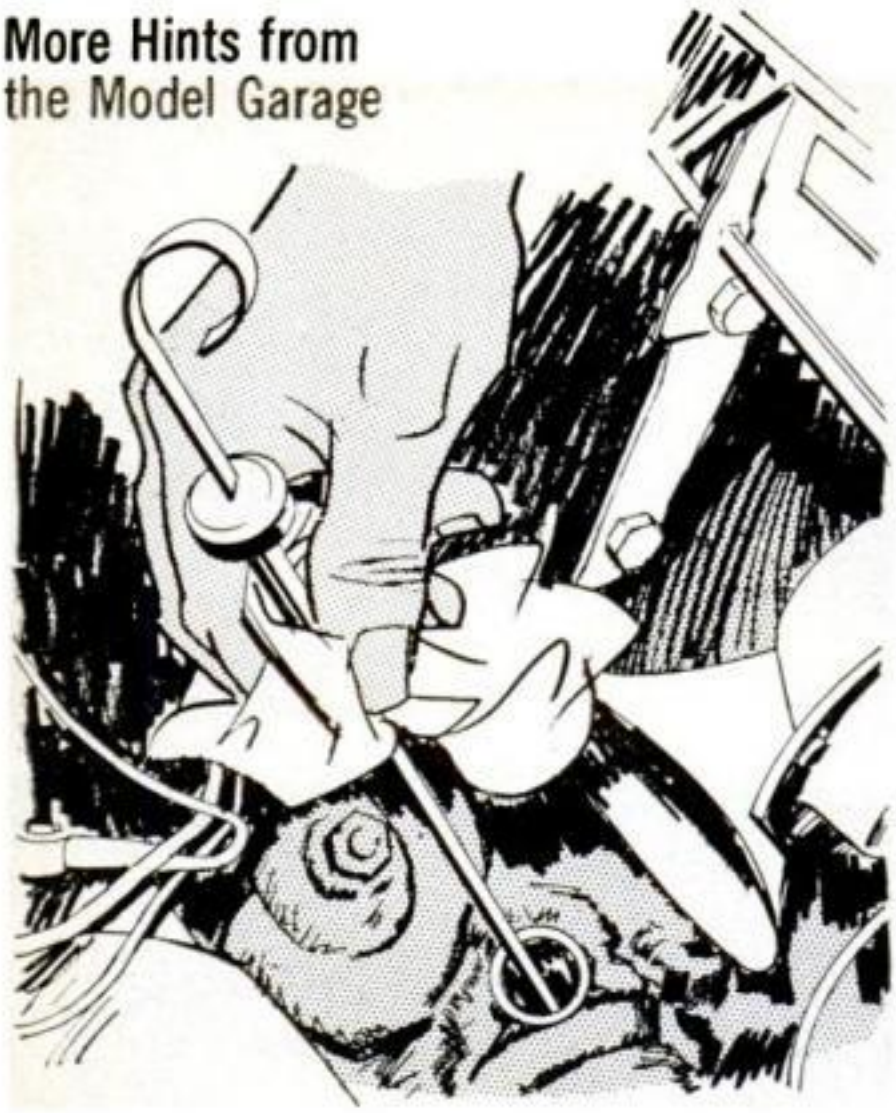
WWP

WESTERN WOOD PRODUCTS ASSOCIATION

Dept. PS-965, Yeon Building
Portland, Oregon 97204

Urheberrechtlich geschütztes Material

More Hints from the Model Garage



The steering-gear casing can fool you; don't assume it's full of oil just because it looks that way. The hole may just be covered with grease while the gear runs dry. To be sure, poke the crankcase dipstick in the lube hole to find the true level.

A drop of shellac or varnish on the hole will prevent damage to fresh paint when you reattach moldings or accessories. The shellac will keep the screwhead from cracking the paint and opening the way for moisture and rust formation.

To clean plastic windows on convertibles, use some jeweler's rouge on a wet cloth. Apply the paste with even strokes, up and down, and wipe dry with a clean piece of cloth. The same treatment works on the plastic of portable radios and TV faces.

Avoid the dirt of flat tires by keeping the spare in a cover made from an oversize inner tube, washed with soap and water, with valve stem removed. When a tire goes flat, snap the cover on before removing the wheel, and then change wheels.

Urheberrechtlich geschütztes Material

This new kind of Skil drill taught Bart Starr something about control!

Controlling the flight of a pass with defensive linemen putting on a blitz is nothing new to the Green Bay Packers All-Pro Quarterback. But controlling the speed of a drill by squeezing the trigger! That's another story.

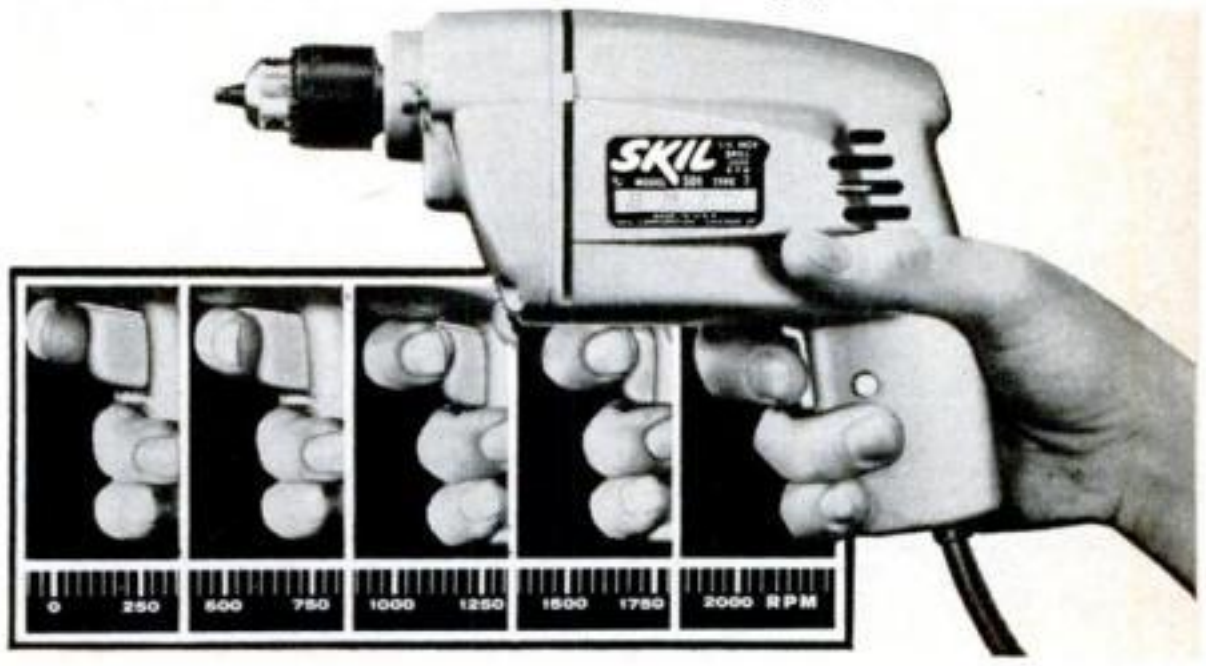
The new Skil Trigger Speed Control drill switch works like the accelerator on your car. The harder you depress it, the higher the speed, from 0 to 2,000 rpm. You match the drill speed to the material you're drilling.

Another plus! You can use the TSC drill as a precision driver, too. Simply exchange the drill bit for a driver bit, start slow to set screw, then speed up until it's snug.

There isn't a drilling or driving application you've ever tried that can't be done either faster, easier or with more accuracy than with a Skil Trigger Speed Control drill.

Free offer! Carrying case, 13 accessories with Model 42501 Drill. At better hardware, department stores and lumber dealers. Skil, 5033 Elston Ave., Chicago, Ill. 60630.

Just squeeze the trigger for any speed from 0 to 2000 rpm.



PICK OF THE PROS

SKIL POWER TOOLS

Urheberrechtlich geschütztes Material

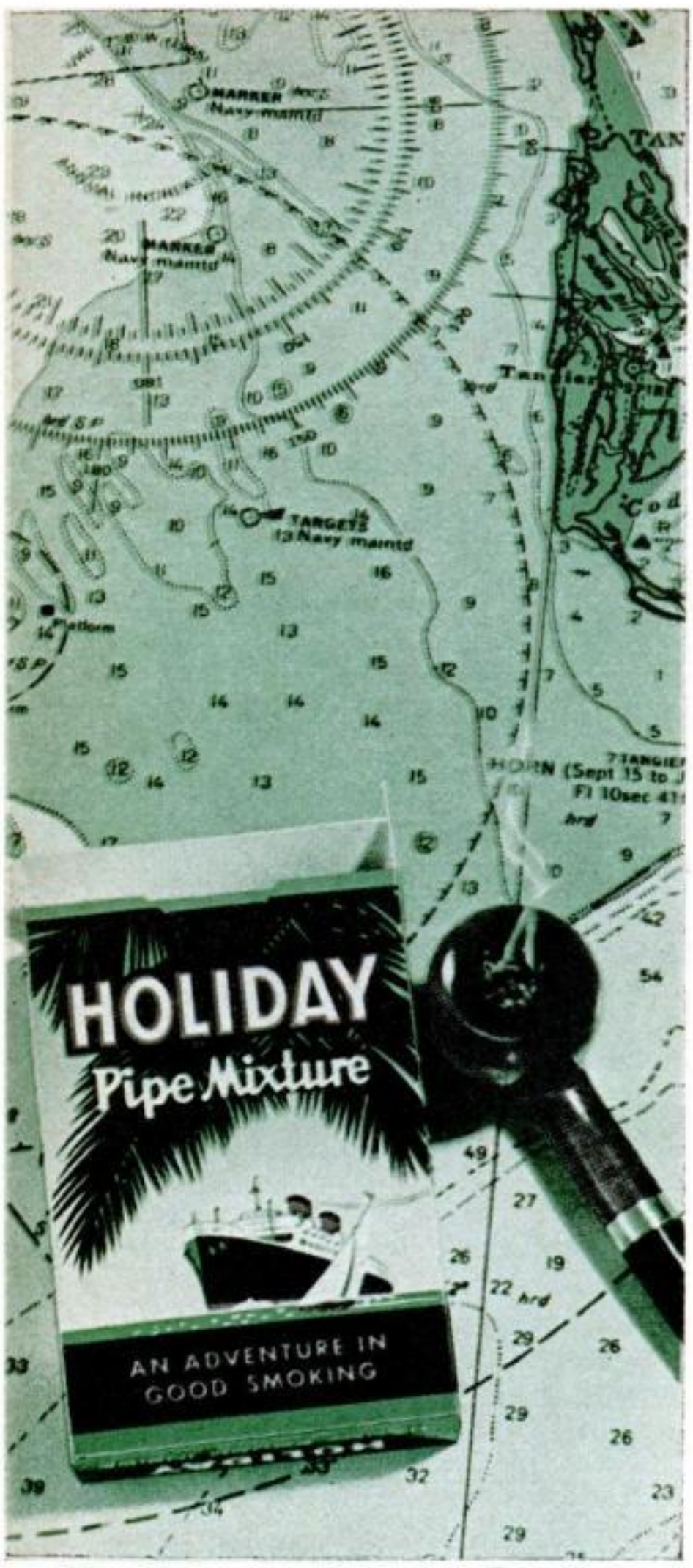


Chart your course to pleasure

On the water or on the town, you'll enjoy your pipe more with Holiday. And so will everybody else! Holiday's famous aroma is welcome anywhere. At home. At the office. At parties. Let us introduce you to this distinguished get together of five flavorful tobaccos. For free sample, jot name, address on a post card. Mail it to Holiday, Box 3-AC, Richmond, Va.

Edgeworth

Larus & Brother Company, Inc., Richmond, Va.
Fine Tobacco Products Since 1877

Report on the '66 Cars from Chrysler

[Continued from page 78]

many fleet owners in the past. Chrysler made the option available to the private owner, too, but never advertised this fact. Now the higher-rate springs, reinforced stabilizer bar, and heavy-duty shock absorbers form the Rally-Suspension kit.

The kit raises roll stiffness and gives the car a sporty feel. In my opinion, it makes the cars safer to handle—the penalty is some loss of shock cushioning at low speeds, but hardly enough to warrant complaints about the ride. The Rally Suspension should be particularly well received on the full-size cars, where Chrysler has softened the standard springs in order to provide a "boulevard" ride for customers conditioned to coil-sprung GM cars.

Another aid to better handling comes in a new power-steering pump, which provides more assist at low engine speeds, less assist in highway driving. This has been achieved by a new flow-control valve that boosts fluid delivery almost 30 percent for parking and maneuvering while cutting it down about 20 percent at engine speeds over 3,000 r.p.m. to give a better road feel at speed.

Braking improvements. The Fury, Polara, and Chrysler are available with Budd front-wheel disk brakes, and the Dart, Valiant, and Barracuda are available with Kelsey-Hayes front disk brakes. Strangely, the intermediates, where the Hemi-426 is offered, have no disk-brake option. Chrysler is working on disks for the Belvedere and the Coronet, but there is no fully developed system ready. The Budd design is too heavy for the intermediates, and the Kelsey-Hayes system is marginal for that size car. As an interim solution, the Belvedere/Coronet drums went up from nine to 10 inches in diameter.

The only real embarrassment to Chrysler engineers is the Imperial brakes—I found them uneven in action even before they overheat and fade.

Some of the best features of Chrysler engineering have been in use for several years and continue in 1966:

- Well-isolated, virtually nonshake, unit-construction bodies.
- Torsion-bar front suspension.
- One of the best automatic transmissions in existence.
- And last but not least: the strongest warranty in the industry. ■■

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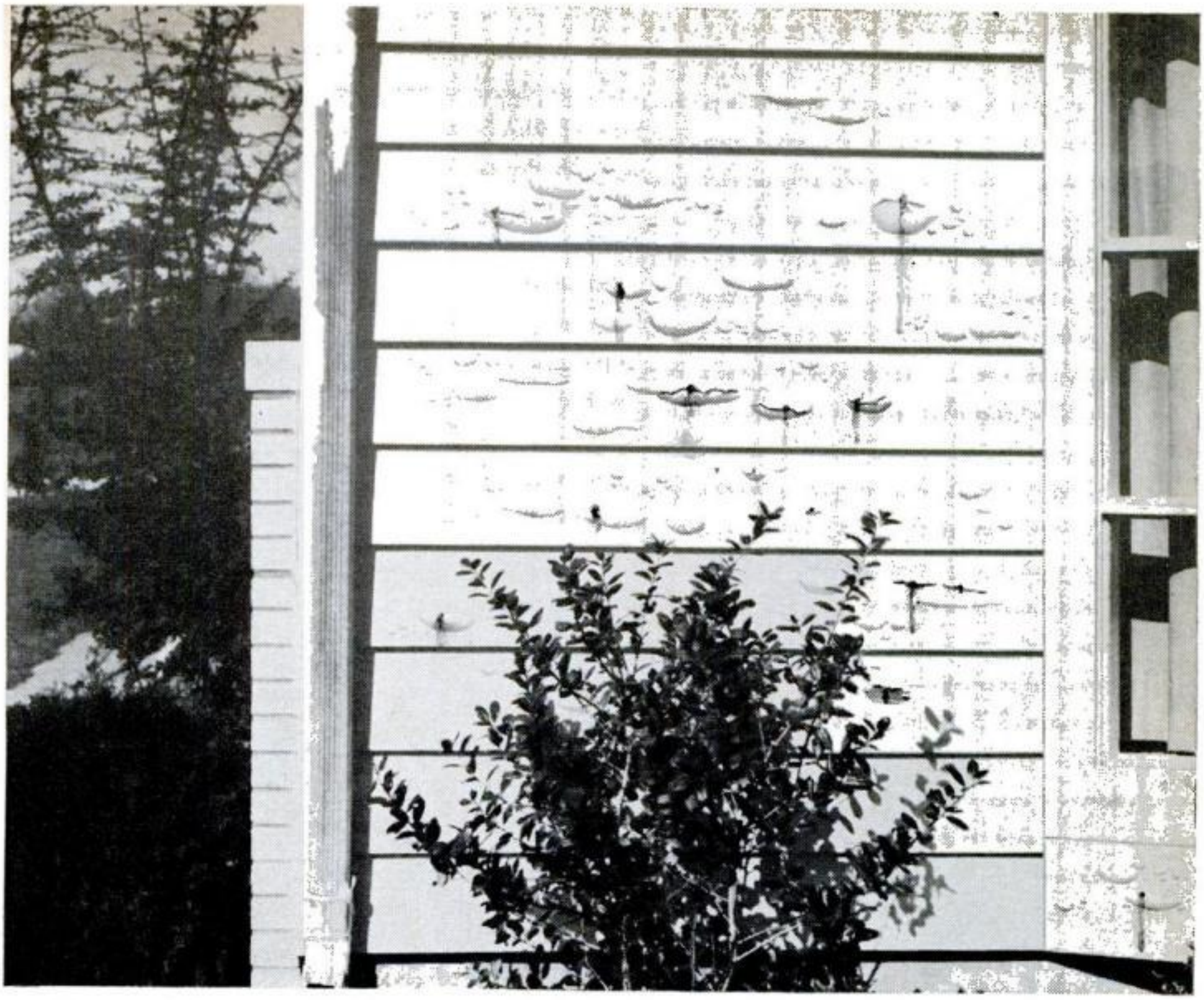


Got this problem? Want to avoid it next time?

The paint you used last time might have brought this problem on itself.

Moisture tries to get out of your home and can't because it can't get through oil-base paint fast enough. In trying, though, it causes blisters. Then peeling.

Du Pont Lucite® House Paint has been proven to resist blistering and peeling far more effectively than oil-base paints.

Lucite dries in 30 minutes. It holds its color longer than oil-base paints do. You have to prime-coat only bare places. You can paint damp surfaces—right after a rain, for instance. You can paint wood, masonry, stucco—any surface. And you clean up—both you and your brushes—with soap and water.

Less work, more wear.

The name is Du Pont Lucite House Paint.

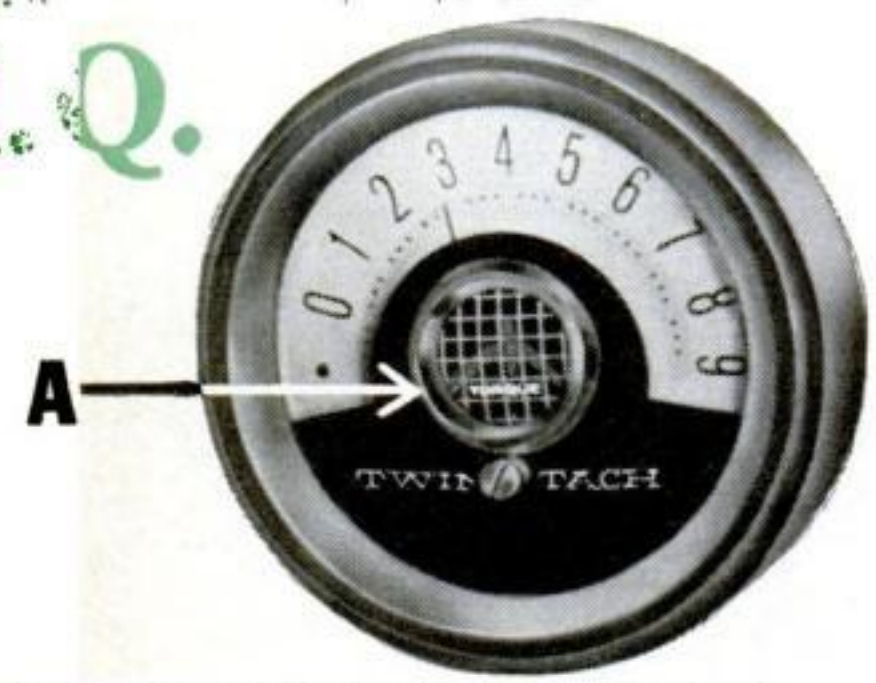
DU PONT

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

Less work . . . more wear

Urheberrechtlich geschütztes Material

Test your... I.Q.



The second scale marked A on this tach measures what?

What does this symbol stand for?

Scale shows torque peak at which an engine produces the most pulling power. The life preserver means Quaker State Motor Oil—the best engine life preserver for your car. Made from 100% Pure Pennsylvania Grade Crude Oil, Quaker State helps keep your car on the road and out of the repair shop. To keep your car running young, always ask for Quaker State Motor Oil—by name.

QUAKER STATE OIL REFINING CORPORATION
OIL CITY, PENNSYLVANIA

Copper Tubing: Key to Easy Plumbing

[Continued from page 136]

to join two lengths of tubing, and tees for running a branch off the main line.

Elbows are not necessary with soft tubing unless the turn is quite sharp. Soft tubing is easy to bend, but it is not easy to keep it from collapsing or kinking. Prevent this by using a bending tool. One type that is cheap, yet works well, is essentially a heavy coil spring that slips inside of or over the tubing to support the tubing walls during bending.

Adapters have threads (inside or outside) on one end and solder or flare joints on the other. Thus you can take off from existing galvanized piping and expand the system with copper. In some parts of the country electrolytic corrosion will be a problem when you join these two different metals. One way to handle this is to put in a "suicide piece" as shown in a drawing.

Flare fittings and unions let you disconnect a pipe for draining or for unhooking a device, such as a well pump, for repairs. Sometimes the plumbing fixture you want to use has a flare connection. Also, flare fittings are handy where using a soldering torch is a fire hazard. Remember, you can't use the garden hose for protection if you have the water pressure turned off.

From a practical standpoint, however, flare fittings take just a bit more doing and are a lot more expensive. For example, a ⅜" flare tee runs about $1.09 compared with only 25 cents for an equivalent solder fitting. That's a big difference.

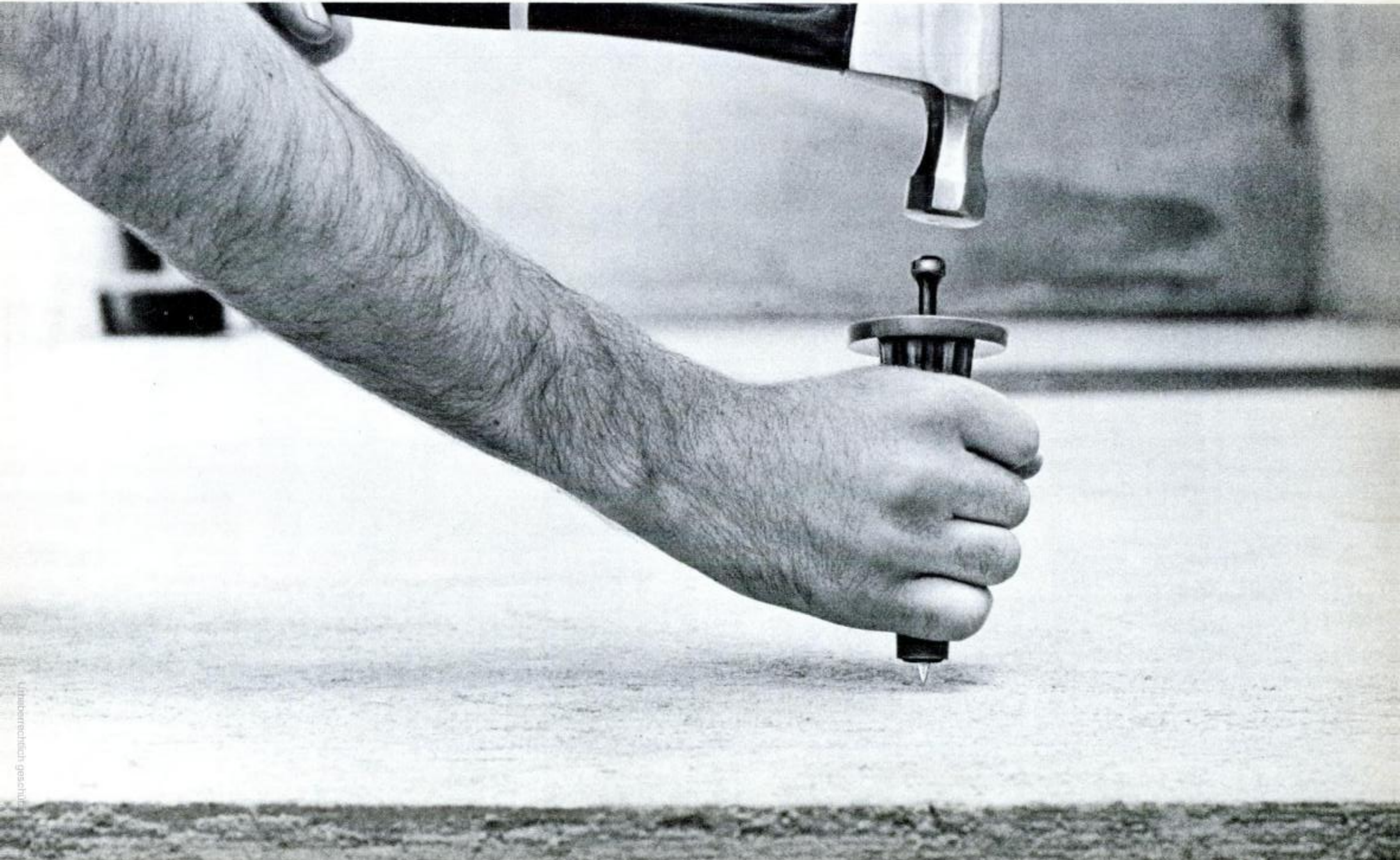
Which tools? Good flaring tools also cost more. The impact type with a conical shoulder is inexpensive, 39 cents, but it leaves much to be desired in performance. It tends to work off center unless the tube end is sawed off neat and square.

A good flaring tool is a lifetime investment and worth the $5 to $8 it costs. Always remember to slip the sleeve nut over the tubing before flaring. It won't go on afterwards if the other end of the tube is secured, and it probably won't slide past bends or any slight irregularities.

Working with copper tubing is easy enough to be fun, most of the time, and the few do's and dont's listed previously will keep you straight.

Still, some things happen that can't always be helped, like completing a job, only to have a carpenter come along later and drive a nail through the soft copper. ■ ■

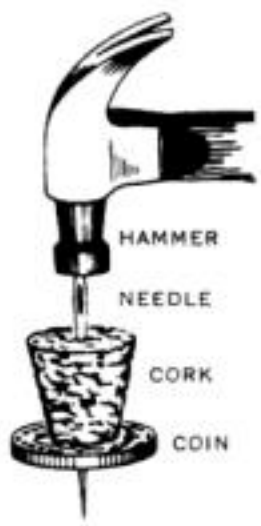
Urheberrechtlich geschütztes Material



Urheberrechtlich geschützt

This new invention drives fasteners into concrete with just a few whacks of a hammer.

It's called Shure-Set®. And it's so simple, it's a wonder no one thought of it sooner. (Matter of fact, the idea comes from the old "poke-a-needle-into-a-coin" trick. Where the secret is to put the needle through a cork before you hit it, so it doesn't bend or break.)



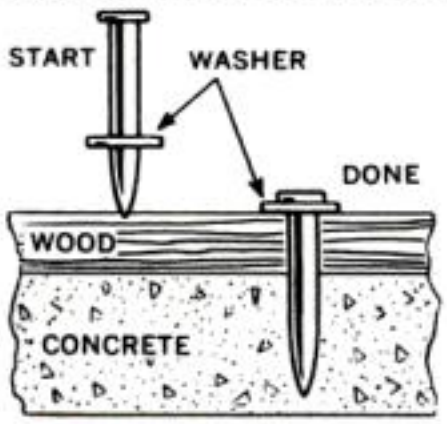
You just push a fastener into one end of the tool and hit the other end with a hammer. A piston inside concentrates the force of the hammer blows.

A few light taps get the fastener started. Then bam-bam-bam-bam-bam. It's done.

You've fastened a 2X4 to concrete. Or a furring strip. Or light gauge metal.

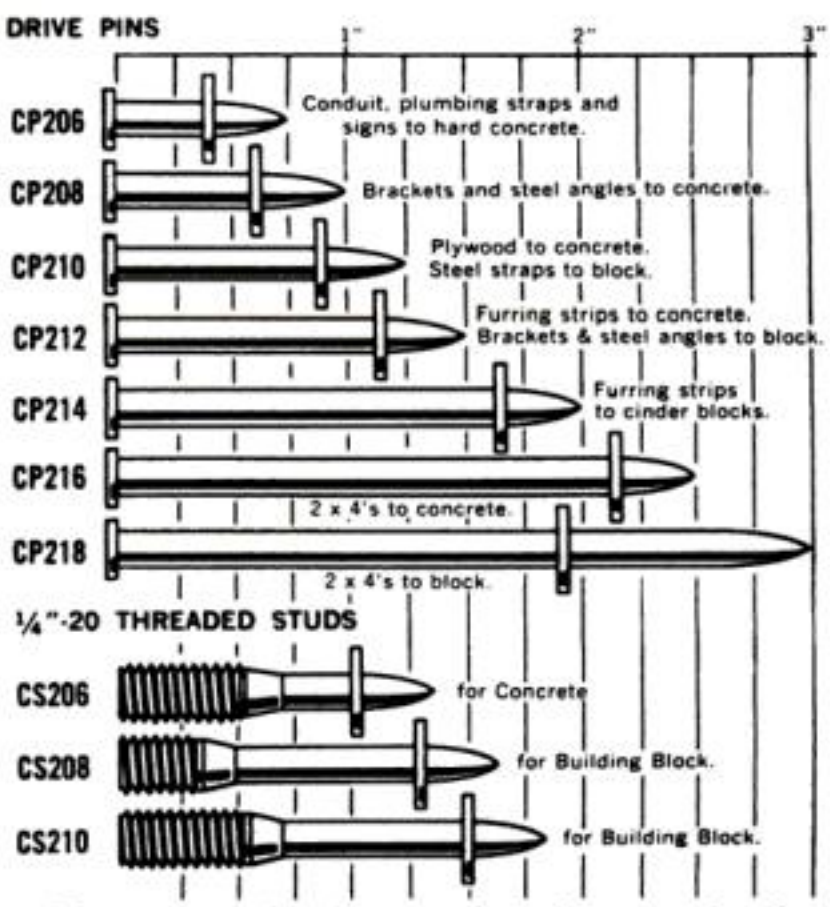
Without drilling. Without expansion devices. Without a lot of time and effort.

Now you can't go banging just ordinary fasteners into concrete, even with a Shure-Set tool. We harden ours with a special heat-treating process (called austempering) so they won't bend or buckle.



And we make two kinds—a pin and a stud. The pin is driven through the material to be fastened and into the concrete. (The washer on the end slips up the shank and keeps the material from pulling through.)

The stud is driven into the concrete with the threaded end sticking out. Then you drill a hole in the material, slip it onto the stud and fasten it with a nut.



They come in sizes to handle practically every fastening job (see chart above). And to get you started, we've packaged a special fastener assortment with a Shure-Set tool that sells for just $3.95 at your hardware store.

All you need is a hammer.

Shure-Set®

Urheberrechtlich geschütztes Mater

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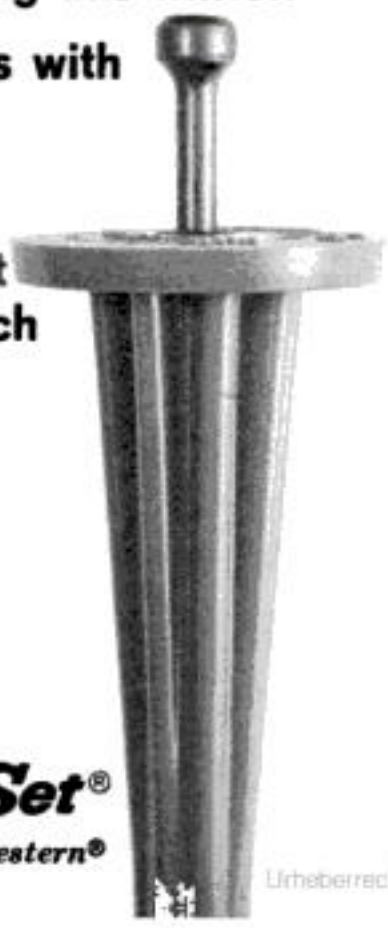
Urheberrechtlich geschützt

ADVERTISEMENT

Which of these basement projects would you have tackled before now if we hadn't been so darn slow inventing Shure-Set?

- ☐ Hang up shelf over washer that your wife's been pestering you for.
- ☐ Put up steel shelving in storage room so you can get the stuff off the floor.
- ☐ Put in a workbench (anchor it to the floor with Shure-Set fasteners).
- ☐ Put up display board for kid's works of art.
- ☐ Make yourself a den by putting up wall partitions (use Shure-Set fasteners to anchor wood sleepers to concrete).
- ☐ Put up pegboard over workbench so you can collect tools in one spot.
- ☐ Build table that folds up against wall to use for kid's electric train set.
- ☐ Put up hook to hang up the hose this winter.
- ☐ Mount punching bag and other exercise-type equipment to help you get rid of that paunch.
- ☐ Hang up moose head you won in a raffle.
- ☐ Panel basement for party or game room (use Shure-Set fasteners to put up furring).
- ☐ Put up a dart board.
- ☐ Install a pencil sharpener so kids won't have to whittle pencils with a knife.
- ☐ Put stationary tub in utility room (anchor it with Shure-Set fasteners).
- ☐ Enclose porch and heat it this winter (heating ducts can be hung in a jiffy with Shure-Set fasteners).
- ☐ Put up full-length mirror so you can analyze your golf swing this winter.
- ☐ Install basement john (attach copper plumbing line straps with Shure-Set fasteners).
- ☐ Put up towel rack and soap dispenser.
- ☐ Put up more electrical outlets and fixtures in the basement (conduit straps, switch boxes, panel boards,–simple to attach with Shure-Set fasteners).
- ☐ Hang flower boxes.



Now the problem is, which to do first?

Shure-Set®

another fastening product from Ramset®—Winchester®/Western®

Urheberrechtlich geschütztes Material

[Continued from page 133]

you'll wind up with the total number of squares you need. Then check the chart on pages 132-133 for the approximate cost of various materials on your house.

Prefinished fittings go right over old trim —window sills, window and door frames, roof rakes, fascia boards, etc. The appearance is almost the same as before. Many home owners prefer to keep the front entrance in its original state because the covers can't always match the intricate design of door entrances.

Aluminum siding. This looks just like painted wood. The color tone is warm and clean. Nails are not visible. Outside corners may have individual caps that conform to the bevel shape of each course, or a single outside corner post extending the height of the wall.

Possible scratches are a shortcoming, although they are easy to patch with matching paint. Aluminum siding is ingeniously shaped for interlock installation. A U-shaped channel along the bottom hooks on to the course below and the top edge is nailed through factory-punched holes.

One manufacturer (Bridgeport Brass Co.) has developed an installation with long metal stringers on the wall into which the aluminum panels snap.

Aluminum also comes in vertical board-and-batten style, in 12′ lengths and 12″ or 16″ widths.

Solid-vinyl siding. This comes in strips 8′6″ long and 4″ or 8″ wide. The plastic is 1/16″ thick and is installed with ½″-thick insulating backer panels that give it rigidity and form a deeper shadow line.

Because there is no coating, scratches will not remove the color and thus are hardly noticeable. The manufacturers (Monsanto, Bird and Son, Mastic Corp.) guarantee the siding for 20 years and state that it will never require protective painting.

Mineral fiber. The widely used mineral-fiber shingles may have embossed striations or sculptured-wood-grain texture. The siding comes mostly in strips up to 32″ long that go up in horizontal courses like clapboard with an 8″ exposure. Coated nails of matching color hold the strips in place.

Mineral fiber is a new version of the long-familiar asbestos-cement shingles, stabilized and tempered to prevent shrinking, curling, or binding. A new development is factory-primed clapboard 12″ wide in

CONTINUED

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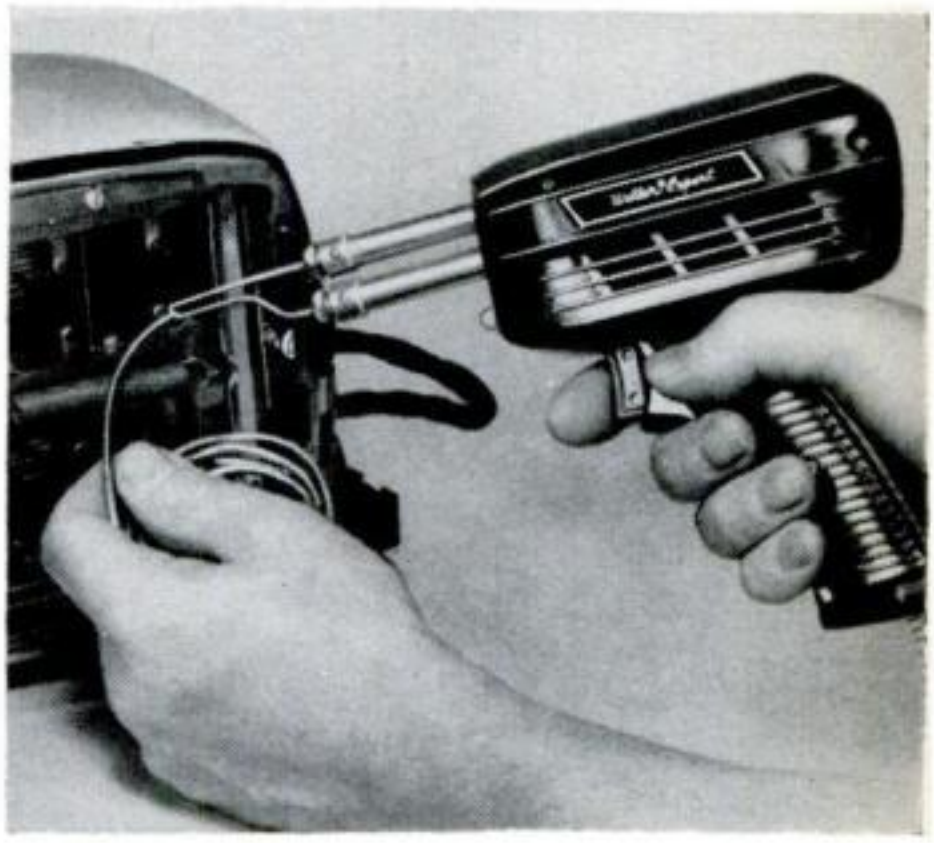

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Includes Expert gun, 3 soldering tips, tip-changing wrench, flux brush, soldering aid, solder and plastic case. Model 8200PK. $8.95 list

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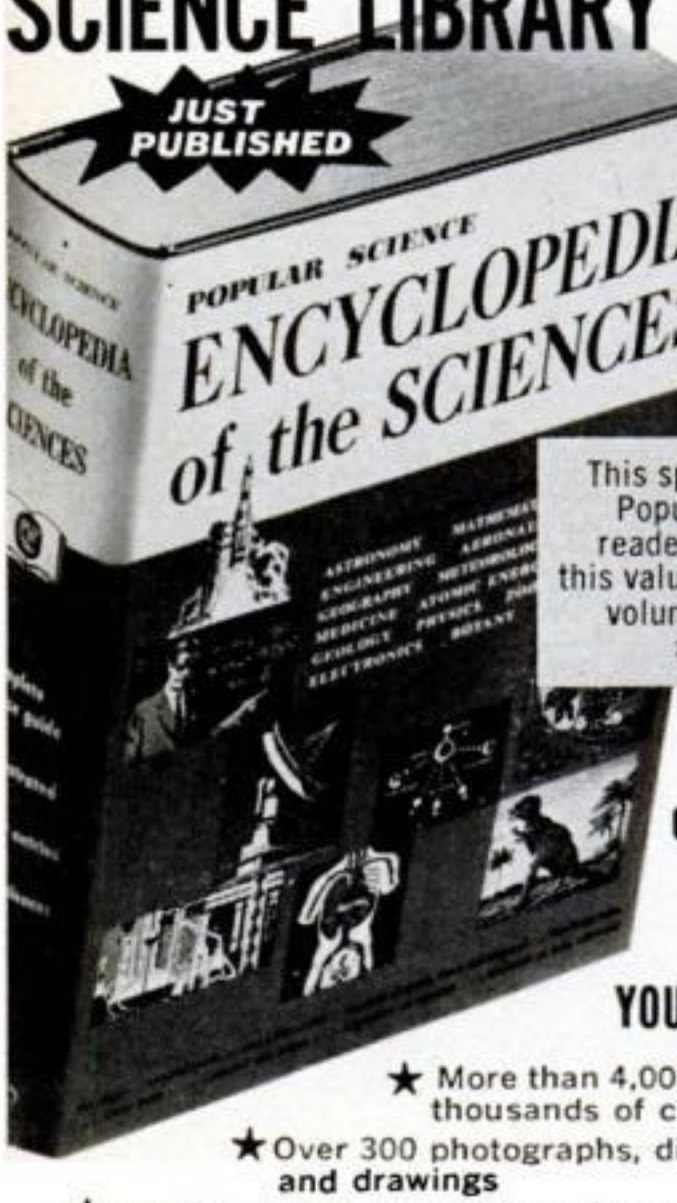

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Those Amazing New Sidings with Built-in Paint

lengths up to 12′ that can be sawed and nailed like wood.

Steel siding. U.S. Steel's acrylic-plastic-surfaced steel siding comes in approximately the same shape as aluminum for interlock assembly.

Hardboard siding. Plastic-finished tempered hardboard provides a built-in color surface and good protection from the weather. Masonite's Colorlok is a clapboard siding with a unique installation system that eliminates visible nailing.

Redwood and cedar shingles. These now come bonded directly to thick insulating board, tongued and grooved so the courses are self-aligning. The insulation backer, on Dua-Lap sidings made by Suprador Corp., and on Glumac shingles by Shakertown, gives a deeper shadow line. Striated shingles come in sections up to 48″, which speeds installation and reduces cost.

Pressed-board sidings. This material, similar to hardboard but not as dense, now comes with a fused-vinyl coating. An example is Insulite—flexible, nailable, stable under changing weather. It comes in planks 8″ wide. Installation involves hidden nailing and adhesive bonding.

Maintaining prefinished siding. Despite all its practical qualities, prefinished siding can be damaged. One point to consider in selecting your siding is how readily a repair or replacement can be made.

Here's a hint: When your siding is applied, save a few extra pieces. Otherwise, you may not be able to obtain matching shingles when you need them years later.

Financing. House siding is considered a major renovation or improvement, and qualifies for federally guaranteed bank loans. If your mortgage is an "open-end" type, permitting increases for specific improvements, you may find it the most economical form of financing, provided there are no extra charges in rearranging the mortgage.

Some manufacturers issue firm and clear-cut guarantees as to the number of years their products should stand up in service, and specifically what they will do in the event of failure. But many manufacturers offer only a "defective-materials" warranty. In these cases, the dealer or contractor may make his own guarantee. All in all, it's wisest to accept only a product made by a company whose integrity you can respect, and buy only from a well-established local contractor. ■ ■

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DANA ANDREWS . . . Star of "CRACK IN THE WORLD" in Technicolor—a Paramount Release—writes . . . "Like most people, I guess, I sure had my doubts about how anyone could sell machines that are supposed to do so much . . . for so very little. I was never more pleasantly surprised! Every claim for them—and more—is true. Putting them through the most rugged workouts, has convinced me that the AMCO people know something no other manufacturer in America has been able to find out. These machines are, without question, a most remarkable buy in professional quality power tools."

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8" TILT ARBOR POWER SAW

$14.95

f.o.b. factory. Wt. 25 lbs.

Includes completely assembled cast iron and steel 8" tilt arbor power saw with ground cast iron table . . . less blade. If desired, RIP FENCE for easier work alignment, $3.50 additional

REVOLUTIONARY PATENTS DECREASE COSTS, INCREASE EFFICIENCY
Full scale power tools of heavy duty 100% cast iron and steel. Streamlined design reduces weight, cuts material and production costs. Special patents provide added efficiency, accuracy, savings. Parts made, assembled, tested and packed right in our own factories, shipped direct . . . save store profits.

DOES WORK OF $75 BENCH SAW as is. Converts easily to equal any $300 floor model cabinet units! Crosscuts, rips, mitres, cuts compound angles, dadoes, makes coves and mouldings.
FREE CABINET BASE PLANS
Use as portable bench saw as received (inset photo) . . . or transform easily and inexpensively into floor model (as shown) guar. to do work of floor models costing $300. FREE plans . . . sheet of ¾" plywood and 3-4 hours are all you'll need. Use your AMCO saw for cutting. Plans provide 27" x 24" work surface, 33" height, pullout sawdust bin, tool storage compartment.
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BLADE TILTS . . . TABLE STAYS LEVEL
• Locks securely at any angle to 50°, raises, lowers 0"-2¼" • Patented tilt mechanism, accurate etched scale • Patented motor mount takes std. ¼ h.p. or larger motor, keeps belt tight, assures perfect alignment at any angle, transmits full power • Takes std. blade, saw insert removes to take dadoe heads, cutters, etc. (not incl.) • Accurate mitre gauge assembly • Ground spindle • Enclosed steel base • "Compo" bearings • Accessories available at factory prices • RIP FENCE, if desired for easier work alignment: Std. size (for bench saw) $3.50; larger fence (for cabinet base, as ill'd.) $4.50.

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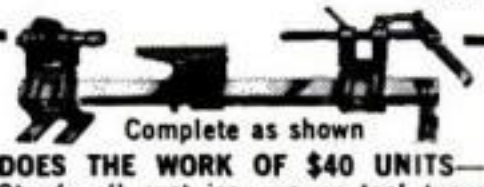
f.o.b. factory

Optional Faceplate for turning bowls, trays, lamp bases, rosettes, etc. $2.50



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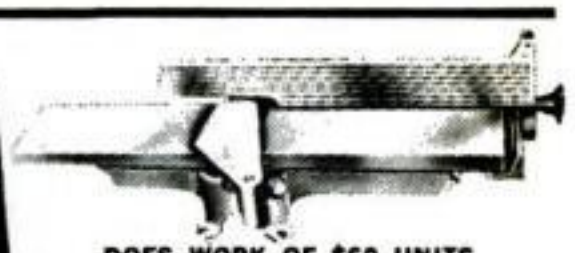

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Now, at little more than a hand tool price, a guaranteed professional quality precision machine which does same work as skilled hand planing . . . much faster, more accurately. Make accurate glue joints; rabetting cuts for doors, window frames, table drawers; square taper cuts for chair legs; accurate beveling.

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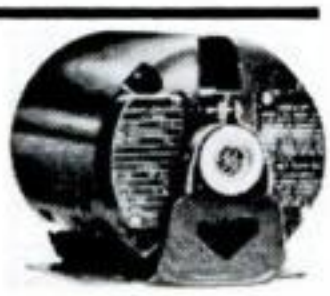

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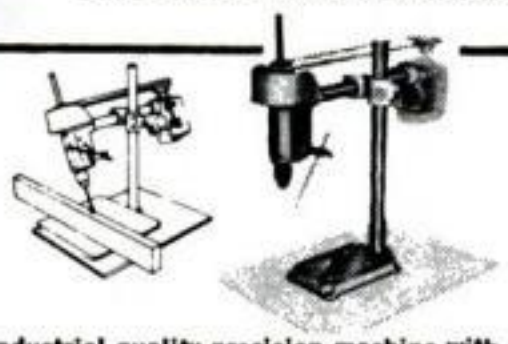

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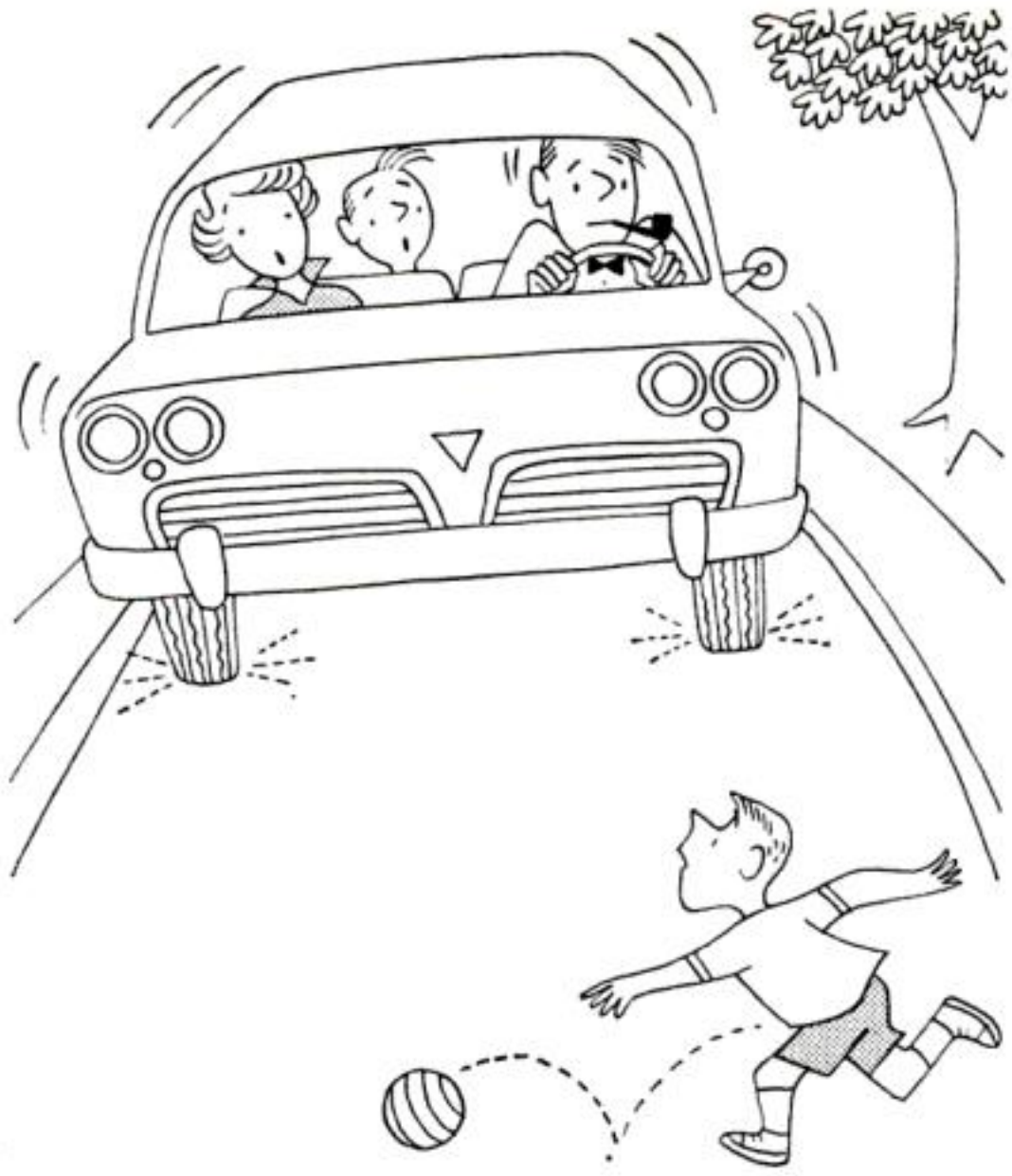
By Roy Doty



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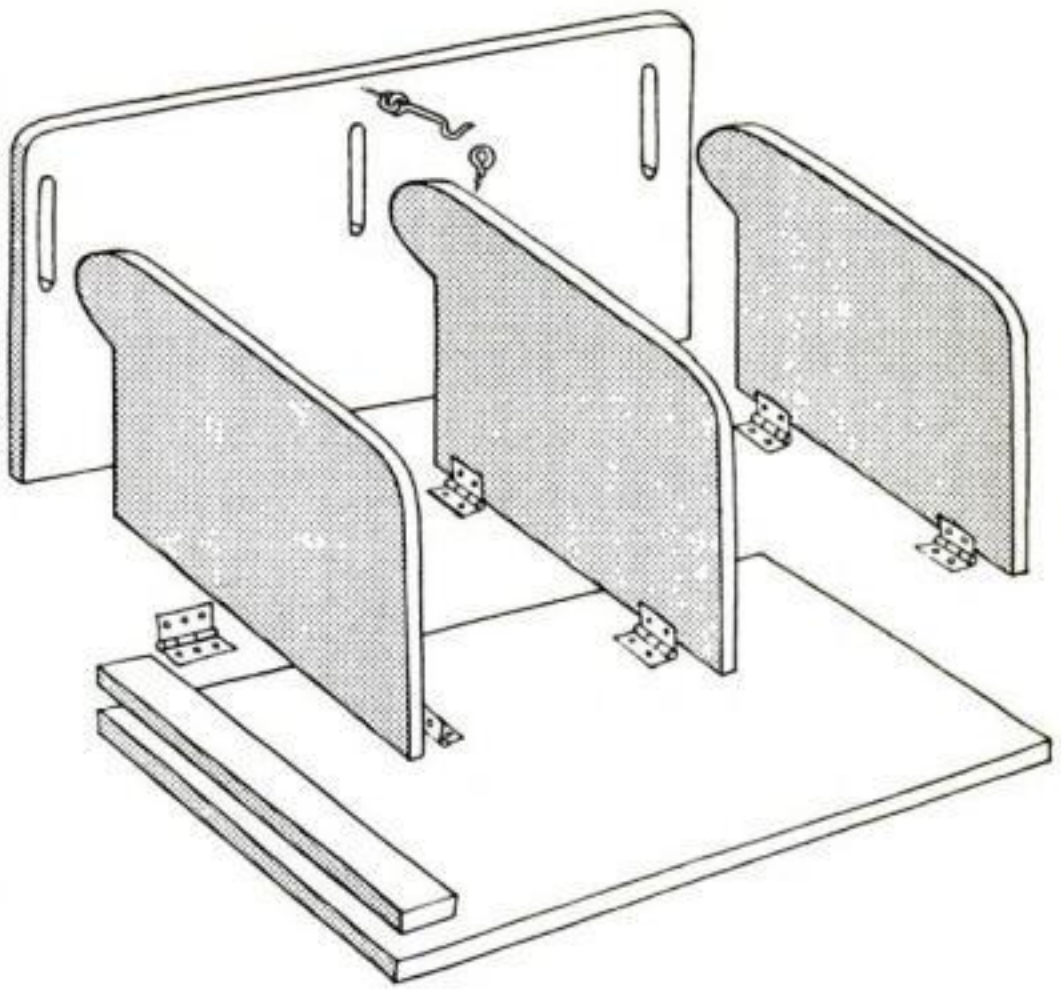

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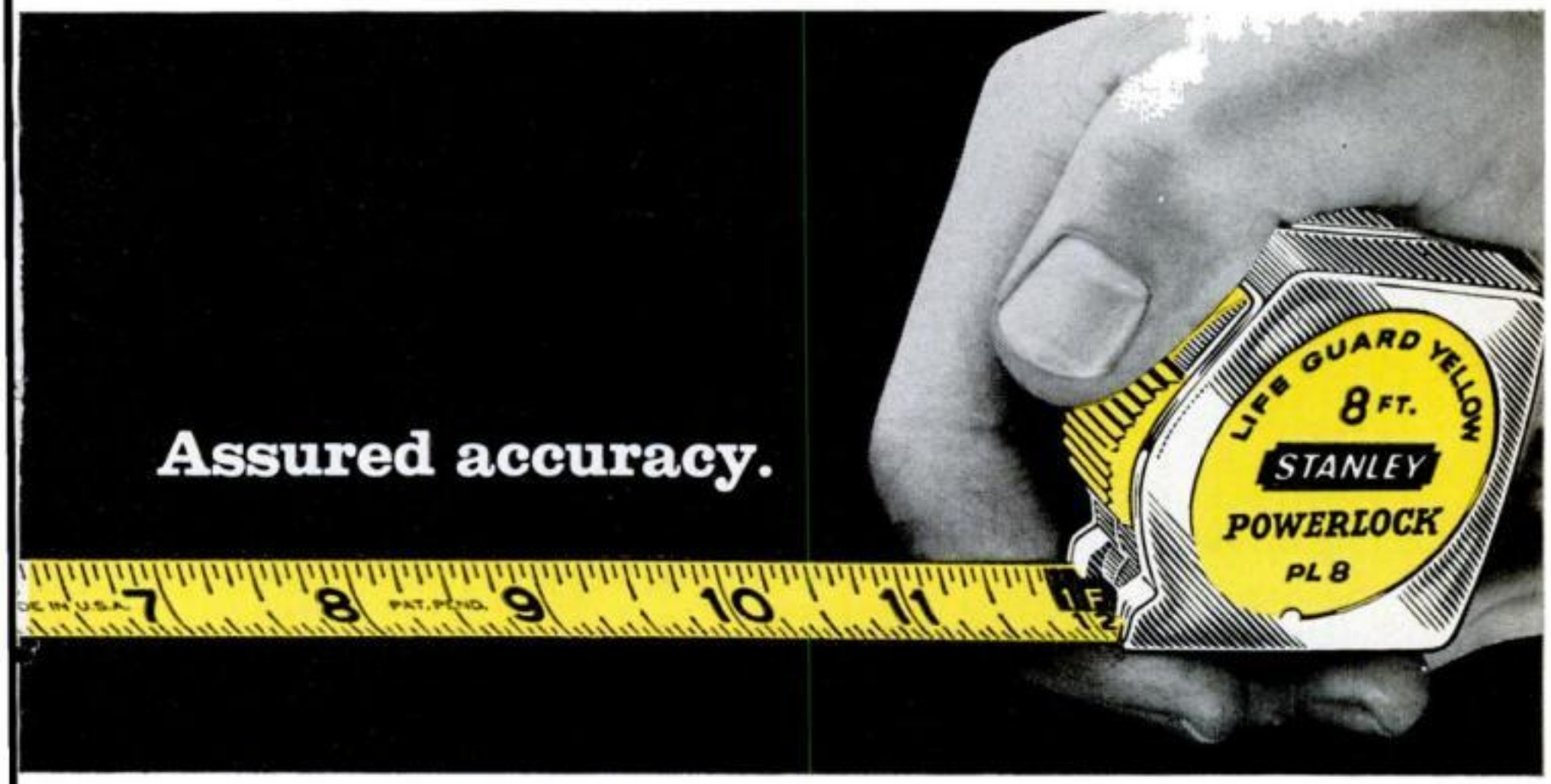

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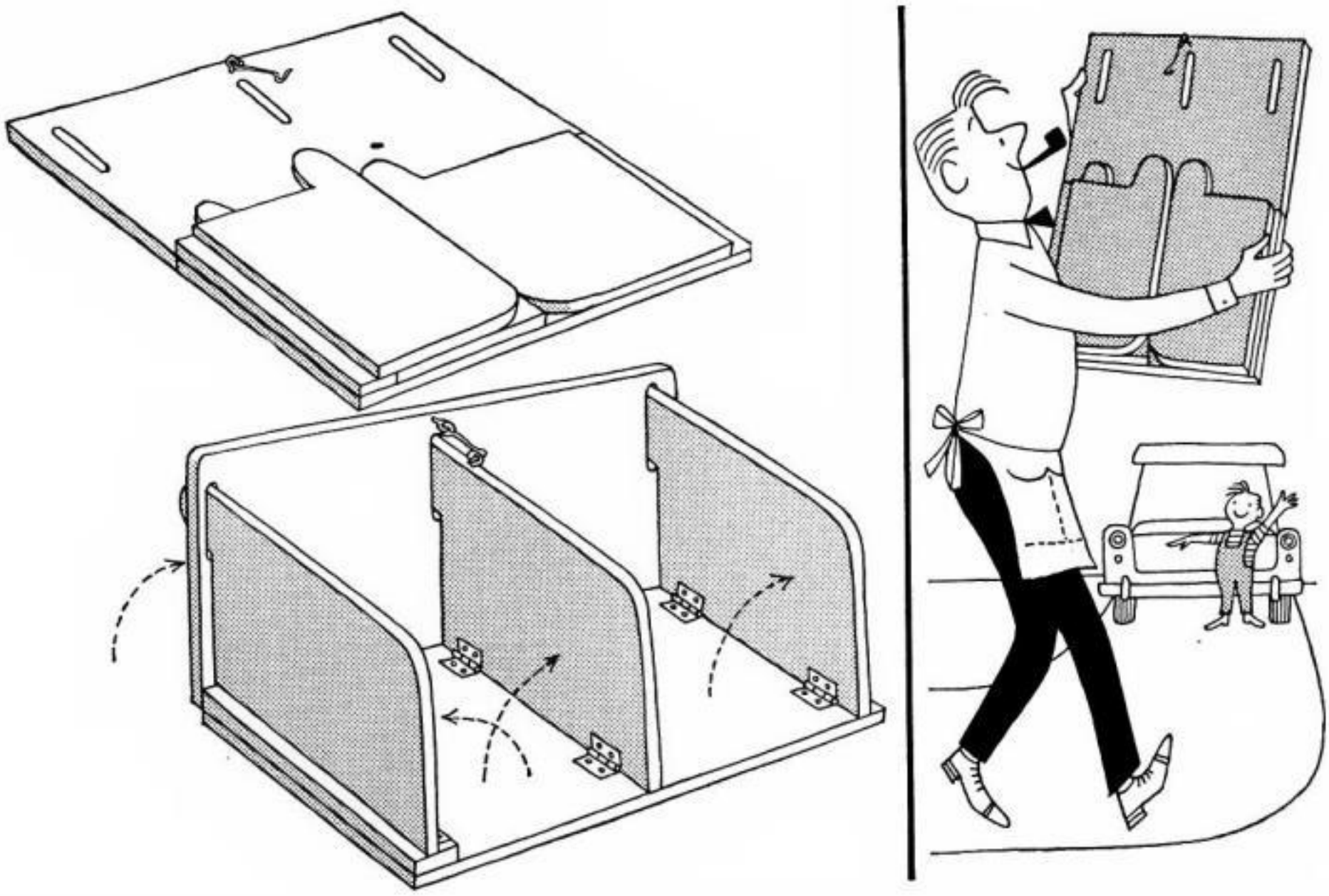

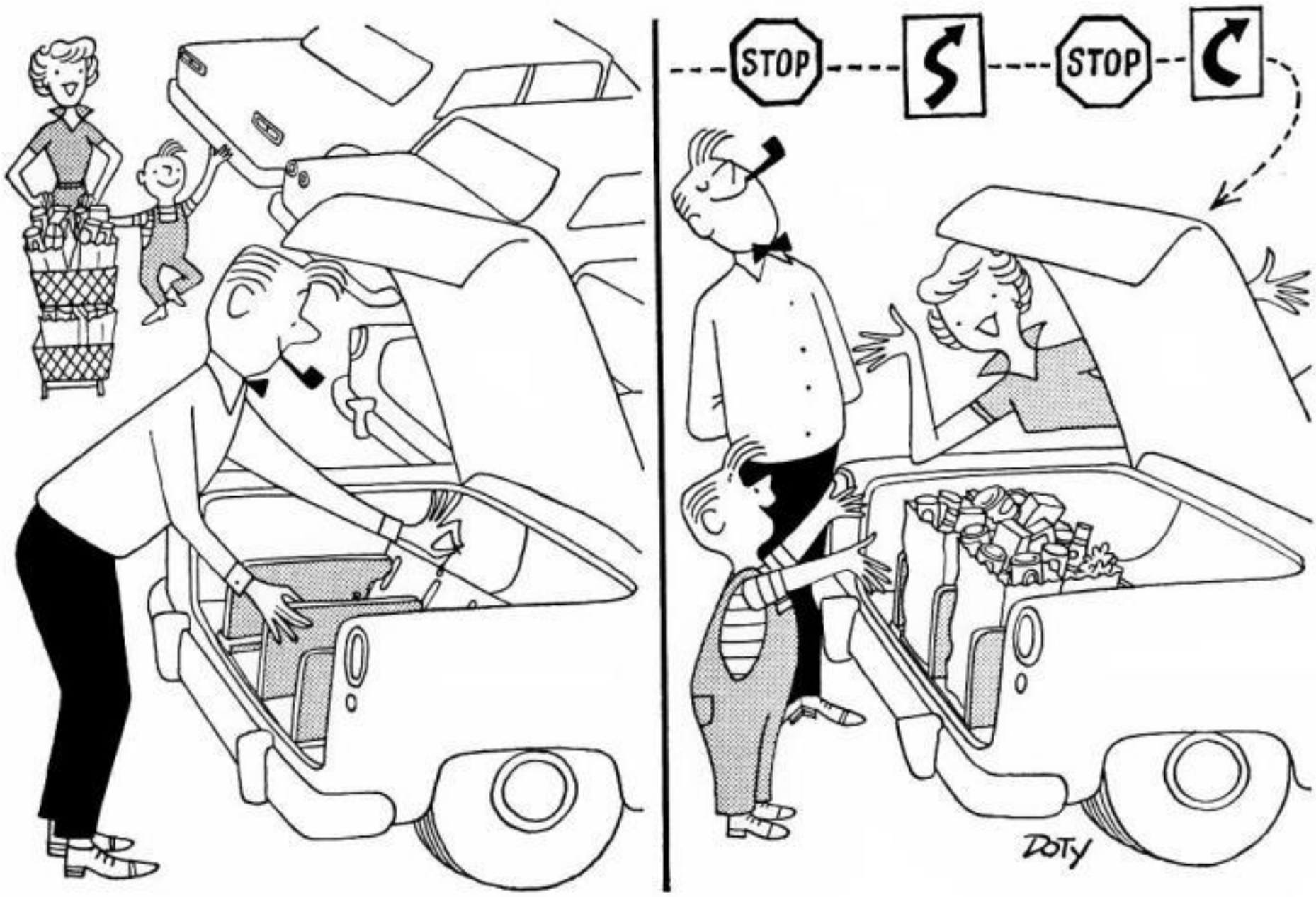

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[*Continued from page 106*]

music, not fuss with elaborate controls. The solutions: playback electronic circuits that require little or no adjustment, and automatic tape-transport mechanisms that do all the work.

A tougher problem arises from the fact that a prerecorded tape is recorded and played back on two different machines. If the two don't have nearly identical characteristics, the sound that comes out will be awful. The most critical areas are:

- Tape-speed accuracy—the tape must be played back on a home player at the same speed it was recorded, on an elaborate professional studio recorder. If not, the musical pitch will be incorrect. Even a one-percent speed difference causes annoying pitch distortion.
- Playback-head azimuth—the angle of the head relative to the path of the tape past it must match the azimuth of the studio recorder's head, or most of the high-frequency sounds will be lopped off.

Solutions: Use the same type of high-quality constant-speed motor the studio recorder has to spin the player's capstan, and hold the playback head in a rock-steady mount that will keep its azimuth accurately fixed.

The audiophile's recorder. Here's the exact opposite of a tape player: Nothing is automatic—the user has complete control of every function. This ability, coupled with individual recording and playback heads—most recorders use a single dual-function head—gives the machine its tremendous special-effect versatility.

Studio-design recorders. These are the largest, and heaviest, portable machines. The reason is an elaborate tape transport, designed to speed tape handling.

- Individual takeup- and supply-reel motors—in addition to the capstan-drive motor—provide exceptionally fast forward and rewind tape speeds. This allows a music collector to run through a long reel of tape in seconds, to pinpoint a particular selection on it.
- Remote control of the tape motion—it saves jumping up to switch off the recorder when a commercial comes on during an FM broadcast being recorded. ■ ■

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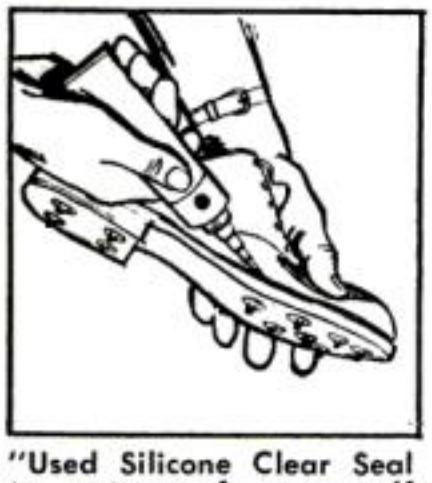
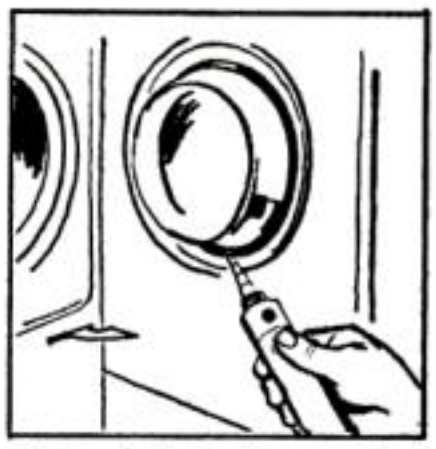
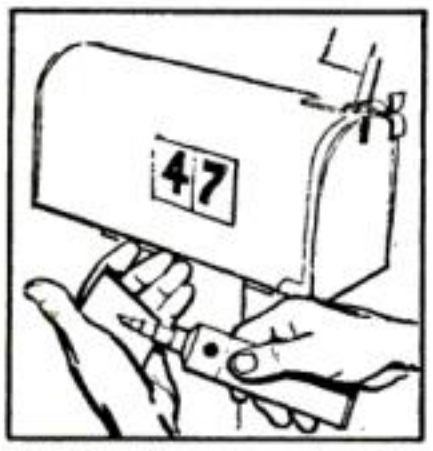


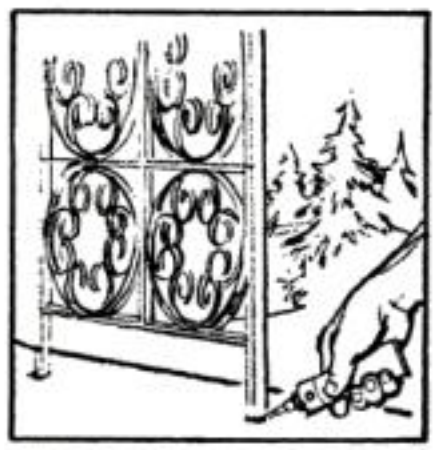
"Used Silicone Clear Seal to waterproof worn golf shoes at sole line. Worked beautifully. Stays flexible." L. L. Lannae, Washington, Georgia. (Clear Seal is transparent, makes invisible repairs on fabric, leather, rubber and other materials.)



"Resealed a door gasket for my clothes dryer with Silicone Bathtub Seal. No more leaks. Only adhesive that can stand the heat." William Jetter, Cincinnati, Ohio. (White Bathtub Seal also caulks bathtubs and tile. Won't shrink, dry out or harden.)



"Sealed house numbers to our rural mail box with Silicone Auto Seal. Now they'll never come off." William M. Smith, Dallas, Texas. (Black Auto Seal repairs convertible tops, cracked batteries and windshield gaskets.)



"Anchored a decorative metal column to our concrete porch floor with Silicone Metal Seal. Easier, faster and more economical than lag screws and anchors." L.M. LaBar, Bethlehem, Pa. (Metal Seal is also excellent for leaky rain gutters and storm windows.)

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GENERAL ELECTRIC

Unique Rolling-Rotor Motor Can't Burn Out

[*Continued from page 85*]

tate—as the rotor would in an ordinary motor—because its poles are in line with the axis, not at right angles to it.

But, though dragged along by a field current moving at 3,000 r.p.m., the rotor doesn't turn at that rate. That's where the wheels come in. To illustrate their kinematic function, cut a round one-inch hole in a piece of cardboard, lay the sheet flat on the table, and roll a five-cent coin around inside the hole. The nickel, which is 8/10 inch across, circulates four times around the hole to complete a 360-degree revolution.

The rule for this simple epicyclic reduction is that in one roll-around, a spot on the circumference of the inner member only moves a distance equal to *pi* (3.1416) times the difference between the two diameters. Thus the smaller the difference, the slower the rotation.

The two-r.p.m. Steromotor calls for 3¾-inch wheels that are only 2½ thousandths of an inch smaller than their track diameters to provide the 1,500:1 step-down from 3,000 r.p.m. Tires are hard rubber, machined to fine limits, to make firm contact. Clearance between rotor and stator is considerably greater and less critical.

Wheel size is reduced to raise the output revs for the faster standard units. The 30-r.p.m. motor, for example, has slightly smaller wheels to increase the gap to 37 thousandths for the necessary 100:1 ratio.

Motors are at present made in two basic sizes to cover the torque range (which varies with speed) from five to 35 inch-pounds. Both are 5½ inches in diameter, and the larger type is 6½ inches long and weighs 6.4 pounds. Weight of the shorter five-inch one is 4.3 pounds.

In the future. Larger models with torque reaching to 120 inch-pounds are planned. Also in the cards are wheels riding in tapered tracks, so that effective speed can be varied by axial displacement of the rotor.

Slow-speed running of these motors eliminates the added cost and bulk of gears, together with their backlash problems. Rotor inertia is virtually absent, due to the gentle rolling action. Self-braking properties, even with the stator de-energized, prevent overrun and resist back-drive from the load.

In fact, DC excitation applied through suitable switching circuits allows precision indexing of the rotor to one-third of a degree. ■ ■

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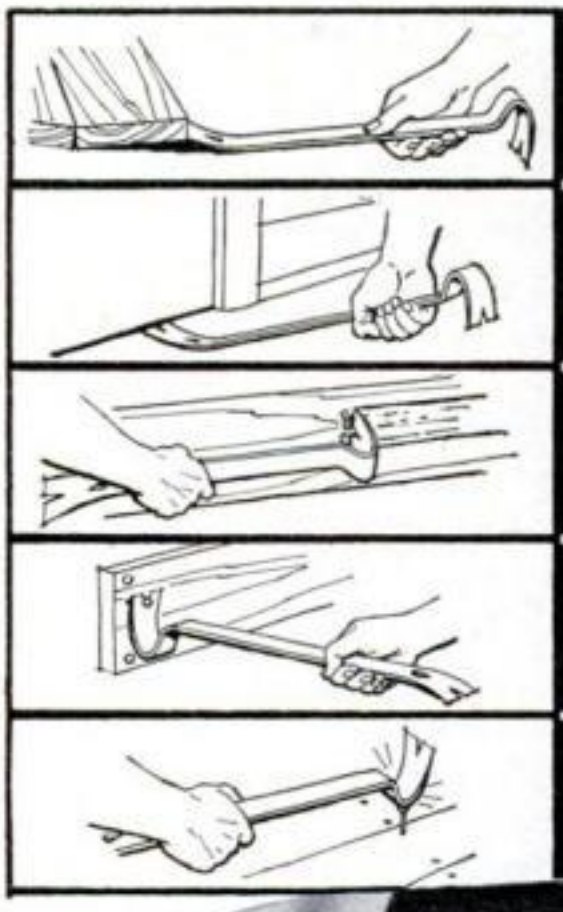

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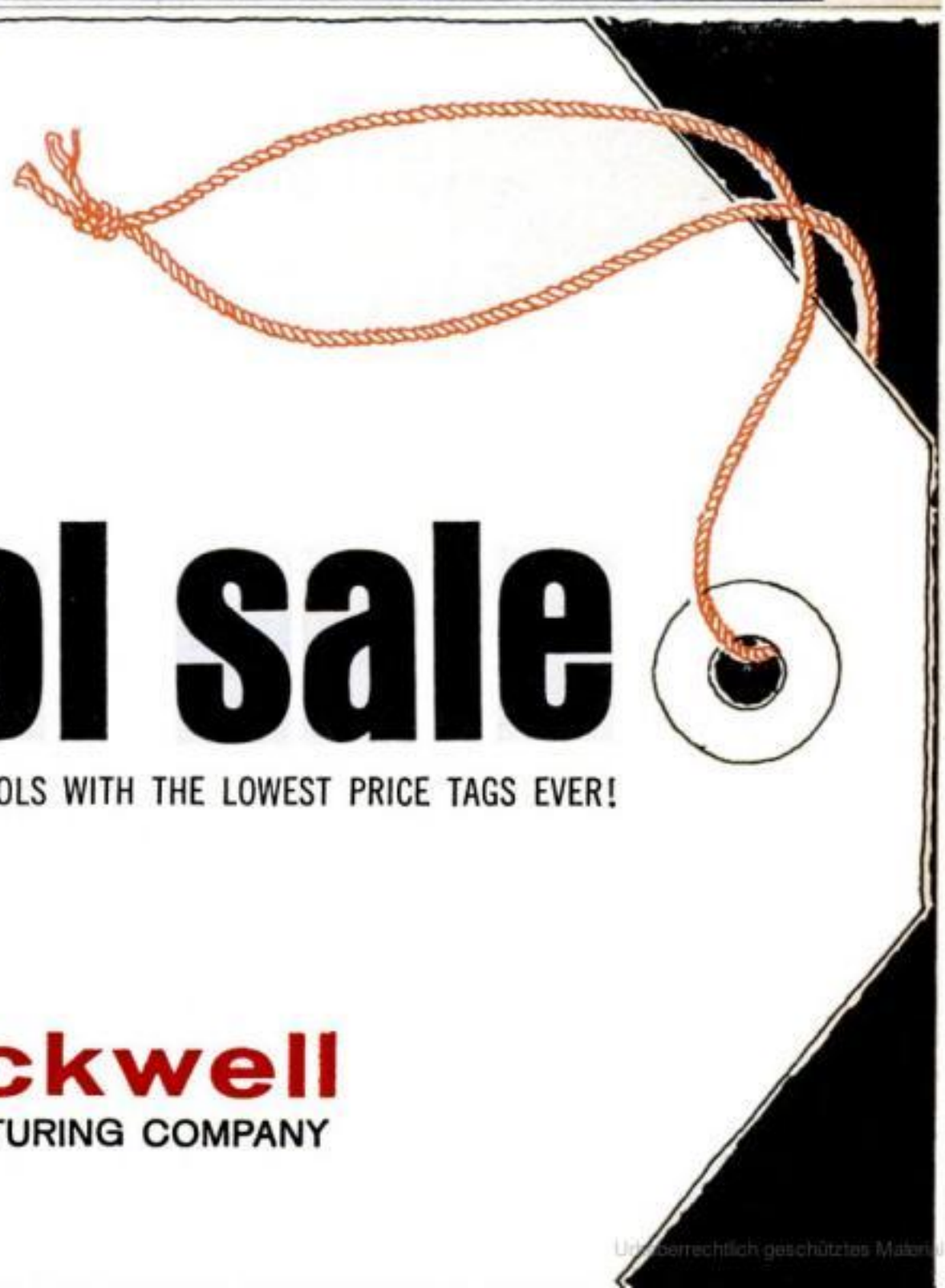

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dozen men, each with a specialty in the physical sciences and an acquaintance with another.

"We've got a lot of talent to round up," ruminated Kaprelian.

Holmes nodded. "I've got a license to steal," he confided.

So they stole. With Holmes' blessing, Kaprelian kidnapped five other men to help with his head-hunting. Mostly, their thievery was confined to other Army labs.

Each man on the staff that Holmes and Kaprelian put together was a practical research scientist. Kaprelian himself set the standard. His engineering degree was backed by a year of law and graduate studies for degrees in both physics and optics. He owned 40 patents in optics and electrophotography.

Two for the price of one. He picked gifted men. If a man was a biological scientist, for instance, he also had an interest in meteorology; if he was an electrical engineer, he had a flair for metallurgy.

That these men were of a particular breed was never better demonstrated than when Ed Vanderlip arrived. In this case it was absolutely not true that LWL stalked, ambushed, and captured the man.

The facts were that Vanderlip, a manufacturer of aeronautical and marine equipment, arrived to sell some things to the LWL. He got fascinated by the lab, went home, resigned as chairman of his company's board, and came back to Aberdeen to work for Colonel Holmes. He showed up for work at the helm of a 50-foot yacht. Unable to support the boat on what the LWL paid him, he had to sell it later.

Kaprelian's acquisitions were truly a mixed bag. Among them was Fritz Hardenbrook, who spent several years in Tibet studying for the Buddhist priesthood. A later arrival was Maj. Dave Hayes, who arrived covered from head to foot with decorations after flying a thousand helicopter ("chopper") missions in Vietnam. But all the men shared one thing—their juices began flowing at the sight of a problem.

Problem: It was taking too long to refuel choppers. Solution—in only nine months—field pumps that refueled 10 times as fast.

Problem: Plane-distributed propaganda leaflets were blowing away when released

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too high or plopping into the jungle when released too low. Solution—in only 10 months—barometrically triggered packets that opened at an optimum 300 feet.

Problem: Field radios were too heavy and of insufficient range. Solution—in only eight months—one weighing 11 pounds with a 500-mile telegraphic range.

Problem: A need for a waterborne signal to attract rescue choppers, and a means of delivering infantrymen by chopper despite heavy enemy ground fire. Solution of each—in only three months—a floating smoke grenade, and a smoke screen laid down by chopper.

Problem: Choppers were targets for rifle fire without knowing it until something or somebody got hit. Solution—in only seven months—an ultrasonic bullet detector.

Problem: A dense jungle sometimes offered no landing space even for choppers. Solution—in 12 months—a treetop airport consisting of two 200-foot-long wire-mesh nets, crisscrossed on the branches to support a landing platform 18 feet in diameter. Soon to be sent to Vietnam, the "airport" is carried and laid down by copters.

Mistakes? Sometimes. The lab naturally has goofed now and then. It developed a truck so loaded with shotguns to foil ambushes that it looked like a frigate. Too clumsy. It developed a perfect ambush detector with an amplified audio pickup. But it scared the daylights out of everybody—it made a mosquito sound like a flight of jet bombers.

As a token of the devotion lavished on the LWL by its personnel, only two civilian engineers have left its payroll since its organization in June, 1962, and that only because of program emergencies in the labs where they were recruited.

Colonel Holmes himself only recently moved onward and upward to another assignment. He was replaced by Col. Robert W. McEvoy.

If there is a standard of devotion, perhaps Ed Kaprelian personifies it. A big, meticulous man who somehow in his utter preoccupation always looks rumpled, he holds the Army's highest civilian merit award.

In the morning, loaded with adminstrative duties, he says enviously to some lucky man on the lab staff: "Here's a problem. Why don't you go off in a corner and think about it?" ■■

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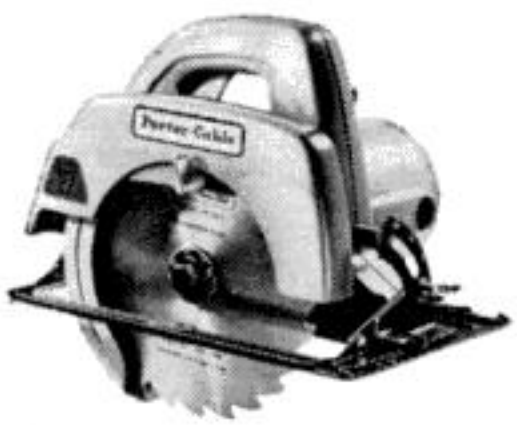

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Three Steps to Installing Ceramic Tile

[Continued from page 147]

much, "strike" the joints with the handle of a toothbrush, a pencil eraser, or some other similar tool. This both smooths and hardens the material. Of course, this treatment is impossible with mosaics. They must merely be wiped clean.

• Keep the grout damp for 24 hours, so it can set. A good way to do this is with clean water in a spray gun you'd use for insecticides. Spray it just wet enough for slight run off, three or four times a day.

The base is important. Ceramic tile, properly installed, is waterproof in the sense that water will not cause it to deteriorate. However, water may get through the tile joints and attack the material it is mounted on. Since this is not only possible but probable, there are only a few materials recommended for "wet" conditions, such as a shower stall or a tub with a shower:

- Portland-cement plaster.
- Asbestos-cement board.
- Certain plasterboards with vinyl or other waterproof coatings.

These will give you the best job—as specified by tile authorities. A second-best job is one that relies on a waterproof primer brushed on ordinary plaster or plasterboard. This may be entirely satisfactory—or, on the other hand, it may fail in time due to moisture penetration.

Generally—for the best job in an existing bath—you'll be smart to put up asbestos board over the plaster, using a mastic plus aluminum siding nails.

On floors, asbestos board, tempered hardboard, or waterproof plywood make an excellent subfloor. Do not put tile down over board floors or it will crack with the come-and-go of the boards. Nail down an underlayment of sheet material.

Grout for floors is usually different from that used on walls. Wall grout may be pure white Portland cement and water. For floors, you need fine sand in the mix.

Selecting the right tile. You can use any ceramic tile any place, theoretically. In practice, however, the high-gloss, glazed types are for walls only. On a floor or a counter top, the glaze will scratch in time.

For counter tops and floors, the porcelains are best. They wear longer, clean more easily. However, there are matte-finish ceramics that can be used on wall, counter top, or floor, if the traffic it will bear is not too heavy. ■ ■

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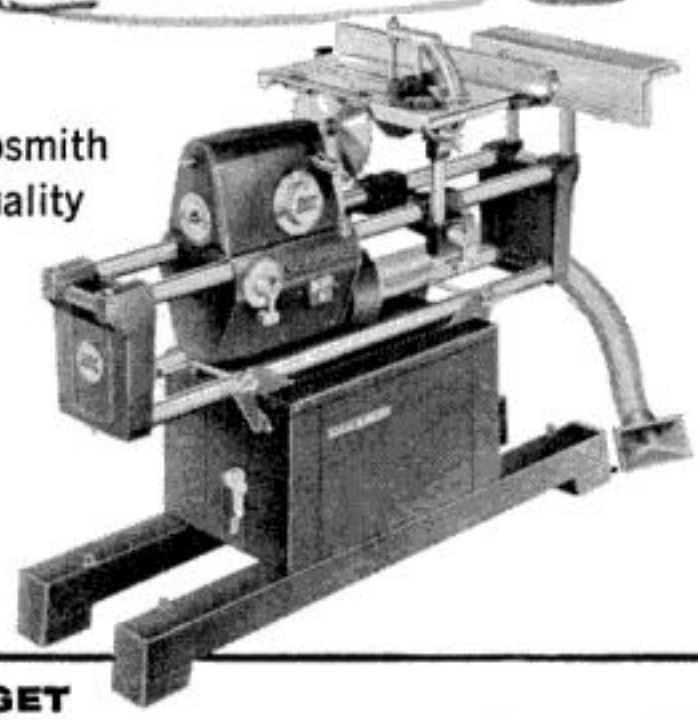

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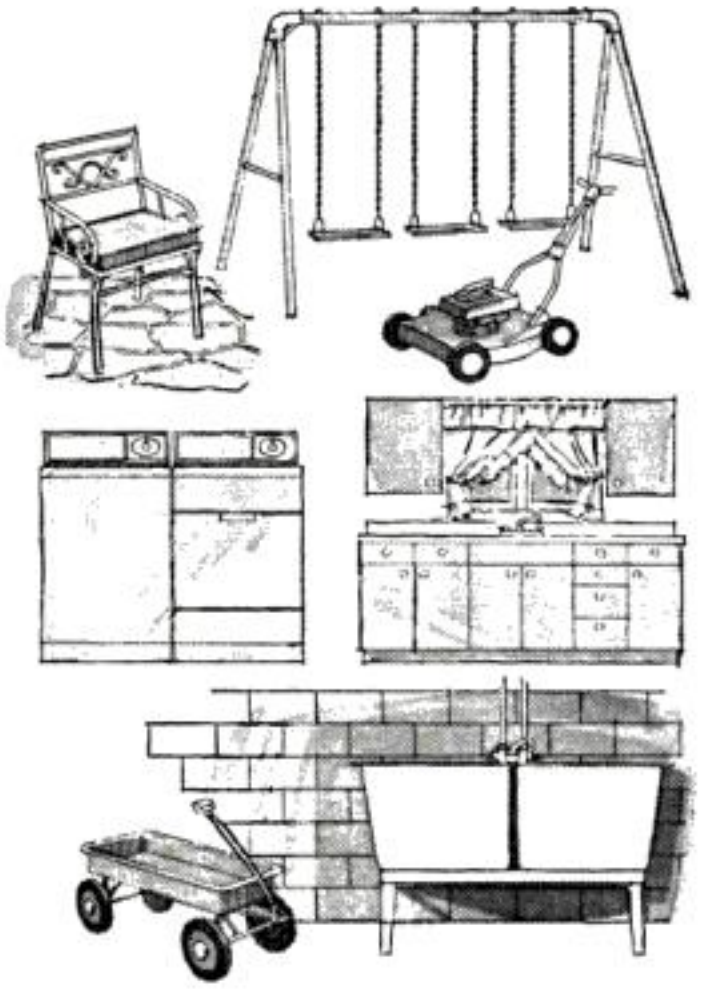

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Electronic Lifeline on the High Seas

[Continued from page 88]

died. Responding to the AMVER call for help, the SS France rendezvoused with the Margarita. The disease was diagnosed as paratyphoid, and was arrested just in time to prevent an epidemic.

In a real cliff-hanger, the fuel from an exploding oil lamp enveloped Johan Green, electrician on a Norwegian cargo ship, and put him into screaming agony. Plasma was needed to save Green's life. Through AMVER, a supply was located at New York's Bellevue Hospital. From there it went by way of a police squad car, helicopter, amphibious plane, and Air Force jet to Argentia, Newfoundland, arriving in time to pull Green through.

Rescue operations sparked by AMVER have saved lives wholesale, as in the cases of the Lakonia, the exploding San Jacinto which broke in two, and the hurricane-tossed Globe Explorer in which all 33 men aboard came out alive. But perhaps the weirdest and most miraculous rescue brought about by AMVER in recent years involved a single man.

"Man overboard." One evening, as third engineer Franz Strycharczk of the German cargo ship Freiburg was leaning over a guard rail, a heavy roll pitched him into the Atlantic. Not until midnight, when Strycharczk was due on watch, was his absence discovered. After a fruitless search, the Freiburg broadcast a "man overboard" message which was fed to AMVER for possible help.

For 16 hours, Strycharczk bobbed around in the water like a cork, realizing that the odds against his being spotted were astronomical. Pilot fish began to snap at his clothing, so he took it off. He was afraid that the pilot fish would attract sharks, and for a time, he thought about suicide. Rather than give in, however, he began swimming, determined to keep afloat as long as possible.

Meanwhile, a SURPIC showed 17 vessels in the area, among them the Coast Guard cutter Absecon. Her captain took a "murky haze" fix with a sextant and headed north with every man on deck searching the horizon. Suddenly, someone on the bridge pointed to a speck moving in the water. As the ship approached, the crew saw it was a man waving what turned out to be his pants.

Incredibly, it was Strycharczk. ■ ■

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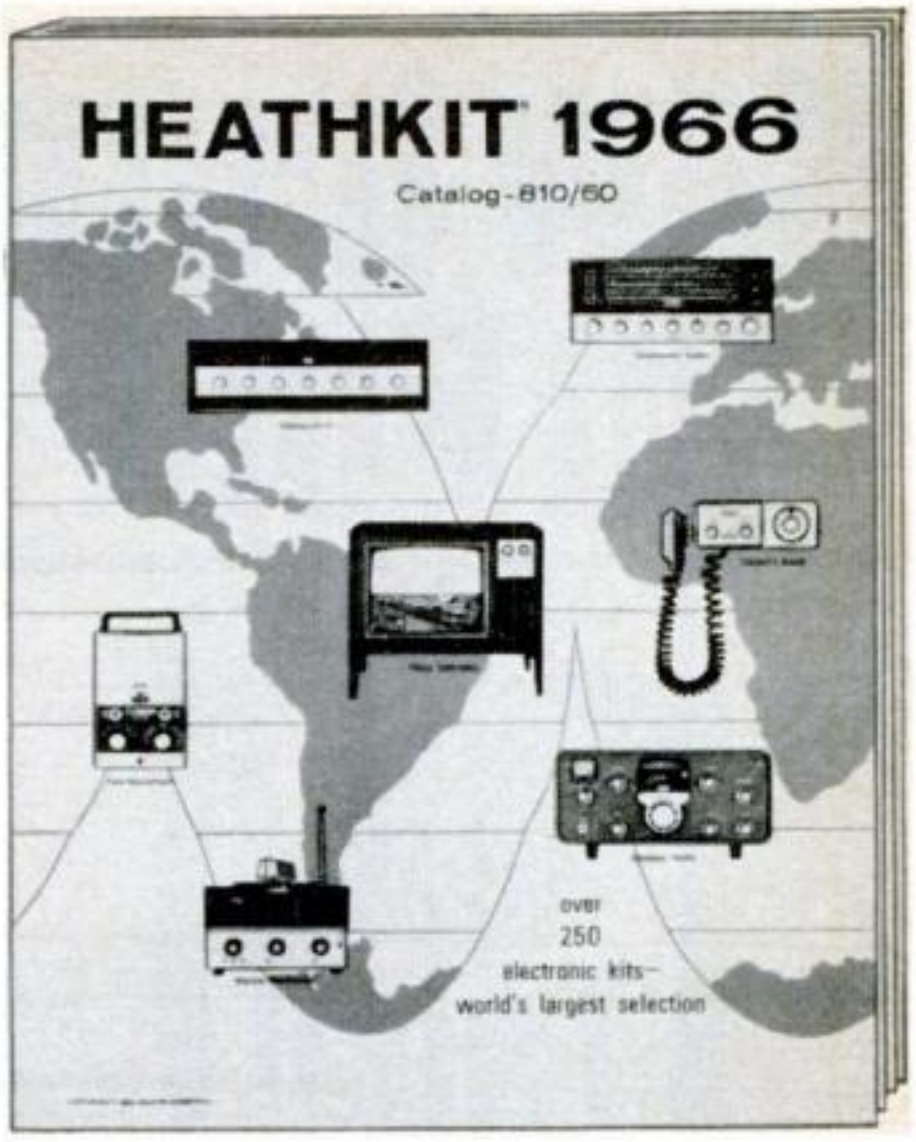

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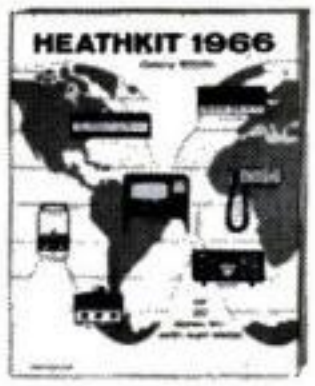

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Two Gems for Car Lovers

[Continued from page 62]

gine-mounting systems have eliminated the worst problems of noise, vibration, and harshness in four-cylinder engines. BMW's twin-carb four is so quiet that, when idling, the engine is inaudible inside the car. Fortunately, it has a tachometer to tell you that the engine hasn't stalled.

Shifting gears on these gems will be a new experience to Americans who learned to love four-speed floor shifts by way of the Volkswagen. Both have synchromesh on all forward speeds, the throws are shorter, and the gates more precise.

The Rover is geared for economy—the BMW for performance. The Rover engine turns slower at a given speed, but the BMW is always ready with a power reserve. For maximum acceleration with the Rover, I found you have to hold each gear a little longer: First gear will take you to 32 m.p.h., second to 54, third to 85, and top gear to a little over 100 m.p.h.

My tests of the BMW showed that at 28 m.p.h. it's time to change from first to second, at 50 m.p.h. you move up to third, and at 78 it's time for top gear (with a top speed of about 105 m.p.h.). On full throttle, neither engine is quiet.

In normal driving, both are almost silent inside. The workmanship is such that there is no shake, vibration, or rattle. The passengers never know what shocks the wheels are meeting.

On top of that, I think the Rover body structure is the most rigid in existence. Rover engineers, working with the Pressed Steel Co., pioneered a new type of unit construction with a skeleton body to which the outer panels are simply bolted. Less radical, BMW produced a lightweight unit-construction shell of advanced design and high torsional rigidity.

Attention to detail. Interior trim is outstanding in both cars. There is carpeting and padding enough to embarrass a Rolls-Royce, armrests and ashtrays, pockets and trays, and a multitude of other little luxuries.

By different routes, Rover and BMW have achieved the same end result: a truly modern automobile of compact size, imaginative engineering, attractive appearance, and high quality. That's the main reason we call them "gems"—but they are also priced like jewelry. Are they worth it? Certainly—after all, you don't look for bargains at Tiffany's. ■ ■

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Urheberrechtlich geschütztes Material

[Continued from page 73]

position at the front of the power head automatically meant it had to be above the transom. The solution was a new side-mounted carburetor. This created vibration and other problems, but also enabled the whole power-head assembly to be mounted several inches lower than it had been. The power-head design was further simplified by the design of a single assembly of three castings that included the starter mount, the idle-relief chamber, and the exhaust chest. This same assembly brings cooling water in and preheats incoming water to 120 degrees. So, with one assembly, overall height was cut, cold-weather performance was improved, and the number of total parts (and thus weight) reduced.

With weight saving a primary objective, the engineers designed the new motor's lower housing to be only .065 inches thick. This extremely thin dimension for die casting called for well-designed curves and ribs, and quality control to make certain each of these very thin castings had the strength to do its job. Before the motor was finished, practically all of its castings were of the thin-walled variety.

There are 531 parts in this 60-pound motor. Small wonder then that testing—and redesigning—of the parts and the motor took several years.

"*Cut-and-try.*" There were problems along the way. I asked administrative engineer Gene Rapplean what went wrong during the development. "Everything!" was his reply. "We were after light weight, so of course our first designs were made to give us the ultimate in this direction. Then we tested these designs to see where they would fail in actual use, and kept beefing up the points of stress until the parts were as tough as we wanted them to be. And our new side-mounted assemblies of carburetor, gooseneck exhaust system, and idle-relief system took a good bit of cut-and-try as well as science."

Once the new 9½ reached the prototype stage, it had to pass the tank tests that are standard for all new OMC outboards:

- Carburetor calibration for clean two-cycle operation from minimum idle speed of 500 r.p.m. or below to 5,500 r.p.m. Carburetors are checked for acceleration and deceleration. They are tested in hot rooms

and in freezing temperatures under conditions of extreme humidity.

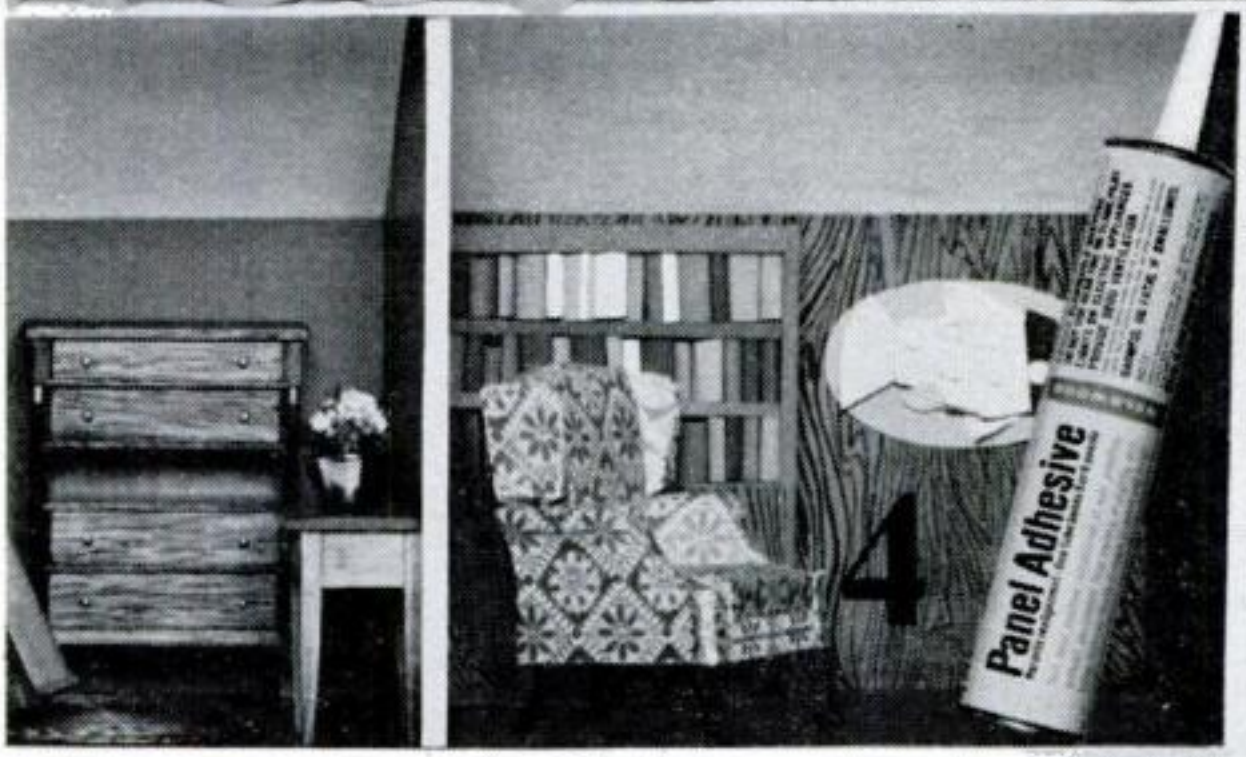
- Idle stability to insure that the engine will idle at 500 r.p.m. or less at all normal angles of tilt or turn. (Checks are made, too, in cold rooms and hot rooms and under conditions of extreme humidity.)
- Starting, to make sure the engine starts on one or two pulls with proper choking at any temperature from 32 degrees to 120 degrees. The engines were deliberately flooded and had to restart, choke open, on five pulls or less.
- Cooling-system pressure, which must be maintained from slow idle right on up to full throttle.
- Life-testing, to insure the engine will go continuously for 1,000 hours, or until failure under unusually tough operating conditions.

These tests are conducted in tanks, and on boats under fresh- and salt-water conditions. Units were dealt punishing blows to test their ability to withstand the shock of striking underwater rocks or logs. Complete engines were run up to full r.p.m. under no-load conditions to make sure they wouldn't fly apart at these extreme speeds.

Once the new engine was designed to be low enough in profile, light enough in weight, and tough enough to take it, it was time to add the features to make it handy. These included an automatic trolling lock, better positioning of the choke knob, addition of a positive reverse lock operated by the shift control, and the addition of a shallow-water drive mechanism. A lift handle was placed on the swivel bracket to protect the user's fingers when the engine was set on a boat transom. And a handy carrying handle was built in at the engine's center of gravity and designed large enough so there would be plenty of room to get hold of it even when wearing gloves in cool weather.

And since the low positioning of the power head meant it was down much nearer to the water, the engine-cover seal was carefully designed to keep water out in the sloppiest going.

The results of all this work: a perky, plucky little motor that turned out to be just what a lot of fishermen and other boatmen were looking for—and, in its first season on the market, the world's best-selling outboard. ■ ■



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[Continued from page 49]

gear. That gives you a lot of noise and very low speed, so you change up immediately. If the ground is not too soft, you can easily start off in second. Go into third at about 20 m.p.h., and you'll feel able to pull a Sherman tank out of the Sahara. On a really steep hill, you might need second gear again, but normally you would just stay in third until you hit hard pavement again. Now change back to two-wheel drive, head for the garage, and start asking questions.

Whys and wherefores. How come it's so quiet in two-wheel drive? That's because the rear axle is coupled to the main shaft in the transfer case; thus, when the front axle is disengaged, the transfer gears are not

Split tailgate opens conventionally, giving access to area behind rear seat. The spare wheel is attached to the lower section.

turning. This not only cuts down gear noise but also saves transmission wear.

How did they get the drive line so smooth at low speeds? At either end of the transfer case you'll find a constant-velocity universal joint. These joints eliminate fluctuations in the rotational speed of the drive shafts and thus permit quieter operation and assure longer life of all transmission parts—plus giving the smooth feeling you mentioned. One more thing. The use of constant-velocity joints allows mounting the transfer case higher, which makes for higher ground clearance in the middle.

How did they manage to avoid nose-dive when stopping? The front suspension uses radius arms and coil springs adapted from the Twin-I-Beam pickup-truck chassis, which gives a very good anti-dive effect.

How is it possible for a four-wheel-drive vehicle with a 92-inch wheelbase to turn inside a 34-foot circle? The outer joints in the front axle permit turning angles up to 37 degrees—a new high in rugged cars.

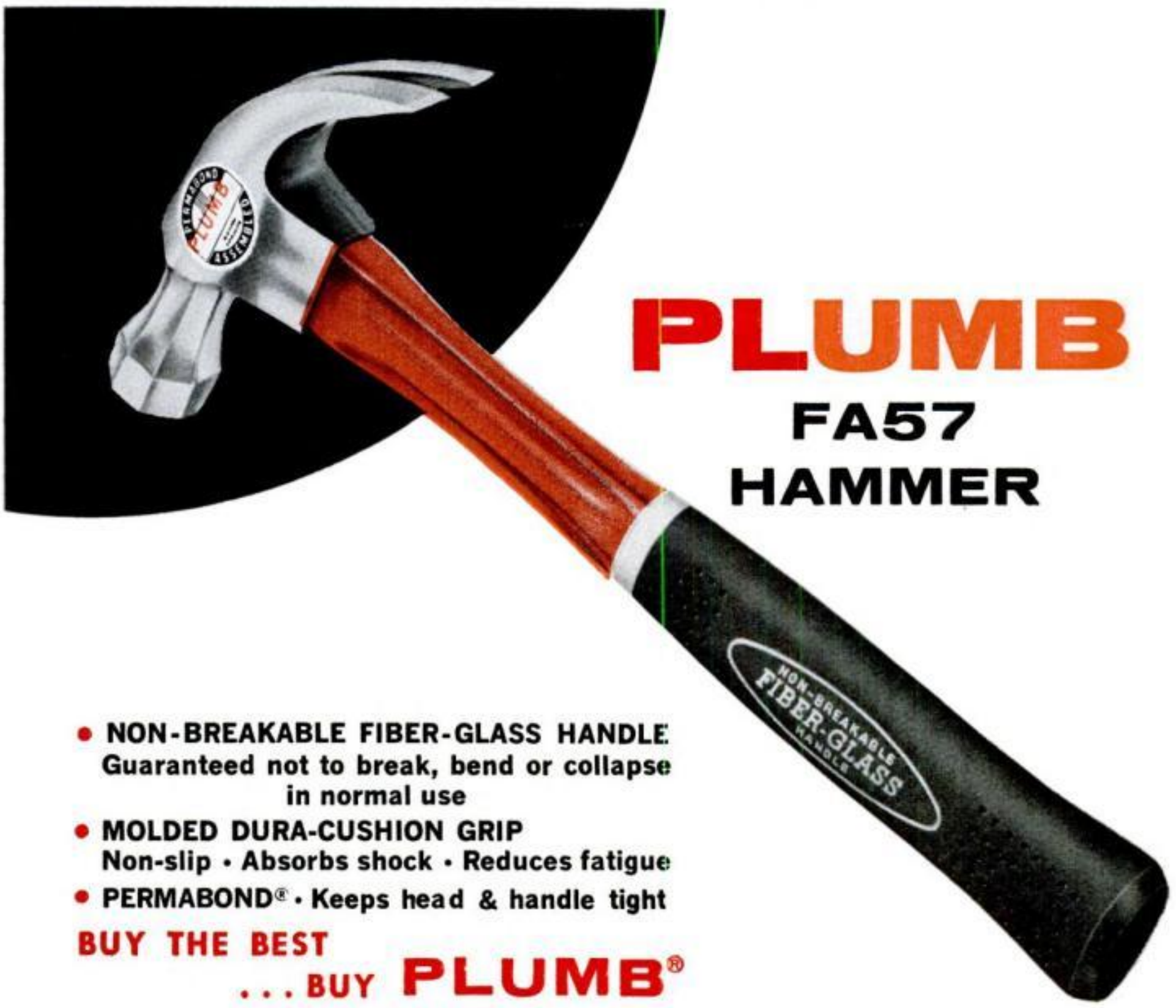
Urheberrechtlich geschütztes Material

Why did Ford choose the front and rear axles from the four-wheel-drive F-100 as a basis for the Bronco, when the parts for the MUTT (Military Utility Tactical Transport) with all-independent suspension were also made in large numbers by Ford? The fact is that the MUTT, great as it may be in the jungle, is not very good for road use, with its small wheels, high ground clearance, and high center of gravity. The geometry of its suspension could become a danger rather than a help when going around turns on a good road. So Ford concluded that a rigid-axle chassis was likely to prove more satisfactory for the general public.

Does the Bronco have power brakes? No. The reason you needed only light pedal pressure to stop when heading down that steep hill is the size of the brake drums. The front drums are 11 inches across; the rear ones are 10 inches across. Such large drums also contribute to long lining life.

Models and options. The Bronco pickup I tested is only one of three available body styles; the others are a wagon and a roadster. The pickup box is 61 inches wide and 55.2 inches long, with a total net volume of 32.8 cubic feet. The all-steel wagon has a Scout-style rear seat (passengers facing forward). Access to the rear seat is easy, as both front seats can be tilted forward. The roadster is the "basic" Bronco. It has no doors, but fiberglass half-doors are optional.

Like most other ruggeds, the Bronco can be supplied with power takeoffs, snow-plow mounts, tow bars and hooks, winches and trailer hitches. Ford has tried to make sure that if the Bronco will go practically anywhere, it will also be able to do practically anything. ■ ■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[Continued from page 69]

celerate to about Mach 6 before letting the second stage go. After staging, it would descend into the denser atmosphere, while turning around 180 degrees and slowing down. At a proper altitude and speed, a set of cruise jet engines—hitherto retracted into the body or wings—are lowered to drive the first stage back to the launch base. Meanwhile the rocket-powered second stage has gone on into orbit.

In the case of an air-breathing first stage, staging is likely to occur at a speed not exceeding Mach 3. To make orbit from this lower initial speed, the rocket-propelled second stage must carry more propellants, and thus be larger. On the other hand, the first stage can return to base with the same set of engines used for the boost phase.

For the orbiting second stage to return to the launch base, it is only necessary to wait for the earth to roll around. Just as with Mercury and Gemini flights, the retro-maneuver in orbit must be initiated at a time when the launch base moves into the area where the reentry flight path will terminate.

An "orbital transport" vehicle such as this could serve, for one example, to carry men to and from orbiting space stations, and to replenish the stations' supplies—as well as to carry out a great variety of other missions in space.

What are we waiting for? There are no insurmountable difficulties in designing and developing a re-usable launch vehicle, on the basis of presently available technology. We need not wait for any great breakthrough in scientific research to come up with quite an attractive design.

In this respect, things are comparable to the much-discussed "SST," the Supersonic Transport: While competitive studies, aerodynamic refinements, and engine advances will undoubtedly continue to improve the economic aspects of that future supersonic airplane, nobody doubts the basic feasibility of the project.

But, in another way, there is an important difference between the two projects. A worldwide airline system, served by subsonic jets at the present time, already exists. Marketing planners for the SST know that as soon as the first airline puts a supersonic transport in operation on one of the heavily traveled long-distance routes, all other carriers flying the same route must follow suit

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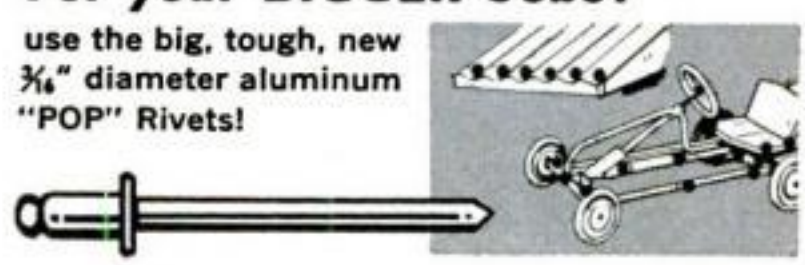

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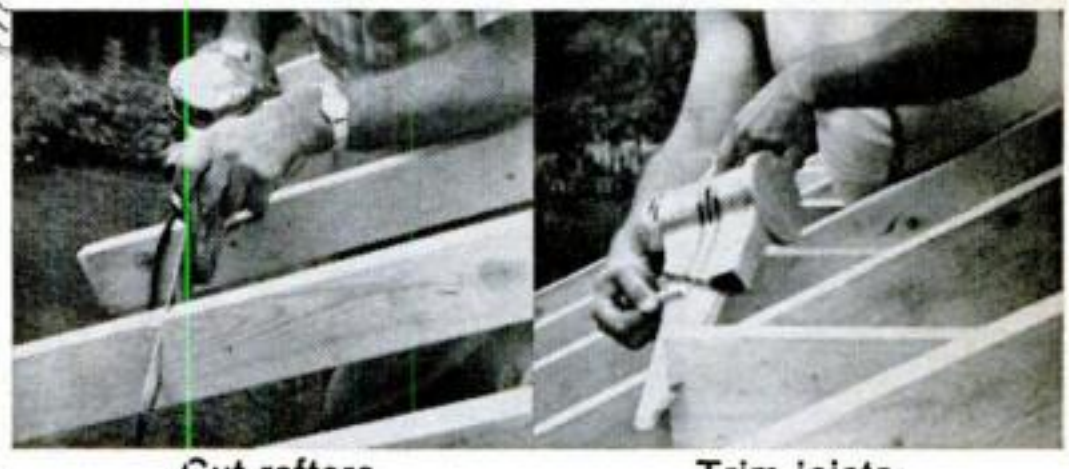
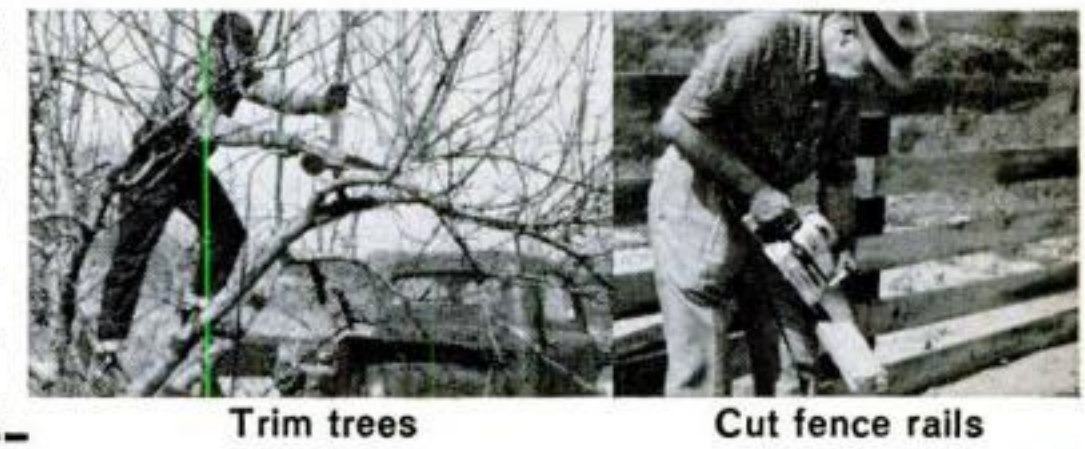


Cut rafters

Trim joists



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or close down. Thus the planners can clearly foresee, even today, the potential sales volume for the SST—and they have a fairly reliable basis for comparing development cost with expected or, at least, hoped-for sales.

Unfortunately, our crystal ball for the future sales volume of re-usable space launch vehicles is not nearly as clear.

To be sure, there is plenty of space traffic. Between Jan. 31, 1958, and March 31, 1965, the United States launched no less than 287 rockets into space, of which 222 were successful. But the payloads of these rockets varied widely, from only a few pounds up to more than 10 tons. The space routes ranged from low orbits, barely skimming the outer fringes of the earth's atmosphere, to interplanetary trajectories grazing our neighbor planets.

A multipurpose launcher needed. Before we can set out to spend a billion dollars or more to develop a re-usable launch vehicle, we must seek for it a many-purpose capability that will satisfy at least a major portion of our space-transportation needs for the next decade or so.

The particular launch vehicle that I have described exemplifies such a "common" design—and the reasoning leading to it goes something like this:

Just like airliners, which make no money while sitting on the ground, re-usable launch vehicles must be kept flying—the more, the better.

Now, we have every reason to believe that the greatest number of space flights—manned and unmanned—will be conducted in low orbits around the earth. These are the most economical orbits to attain. They offer the best vantage point for observations of the earth. And they are just as effective as any higher orbit for most astronomical, astrophysical, and other scientific studies to be conducted in space.

The kind of space "business" beyond the moderate payload capability of the re-usable launch vehicle described here must be expected to be of rather low traffic density for the next decade or so. For such more-demanding missions—with very heavy payloads, or leading to destinations much farther away from earth—nonrecoverable launch vehicles, like the Saturn V rocket developed for the Apollo lunar landing program, are likely to continue to be a better bet for years to come. ■■

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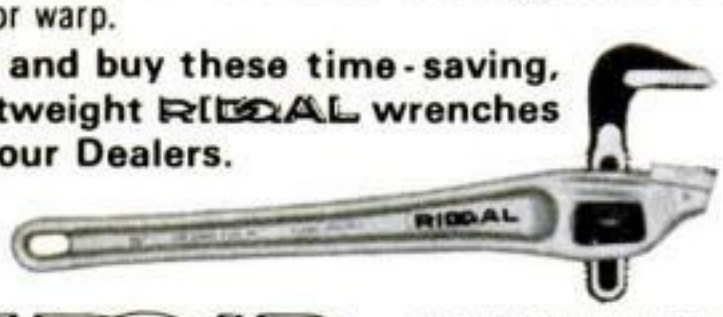

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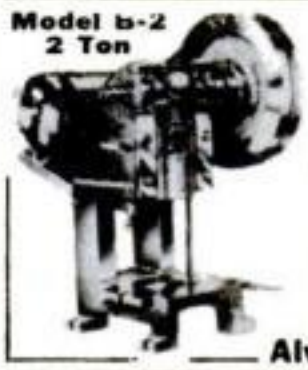

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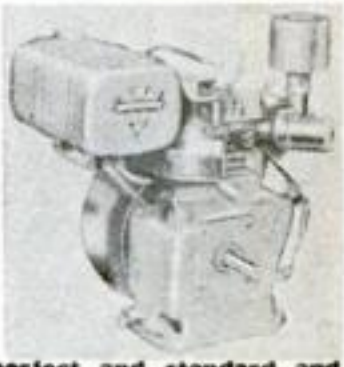

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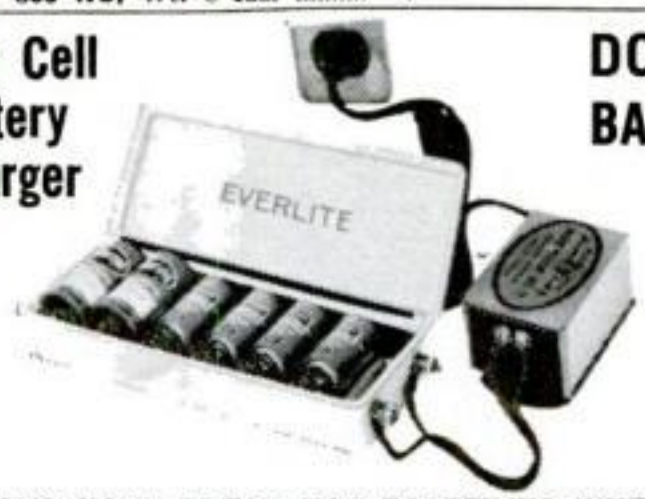

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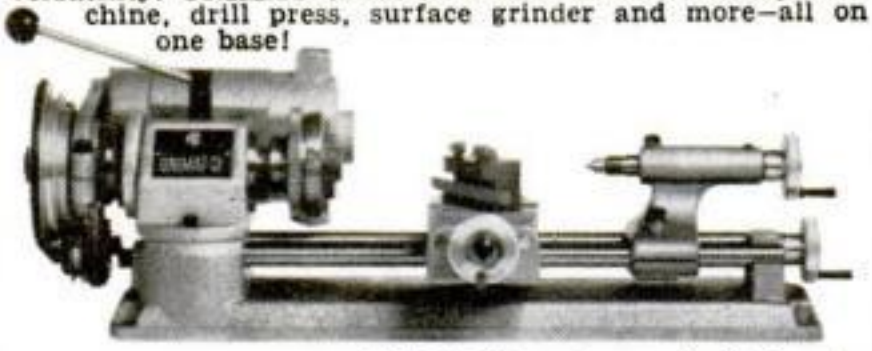

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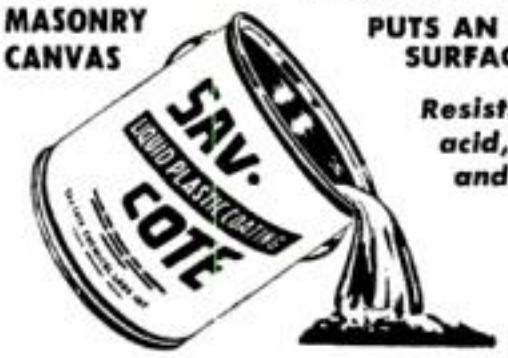

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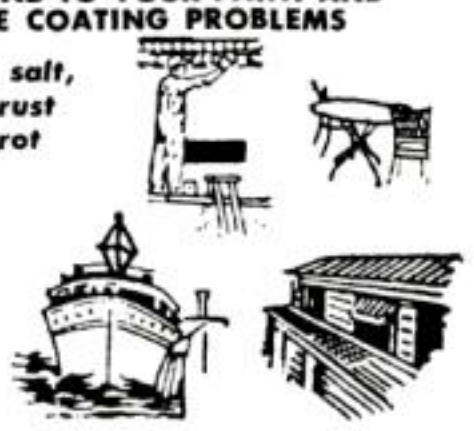

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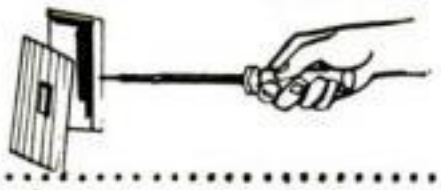

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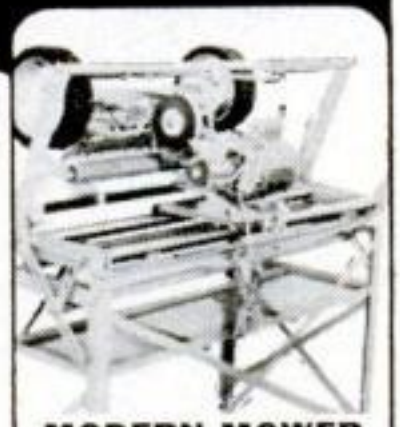

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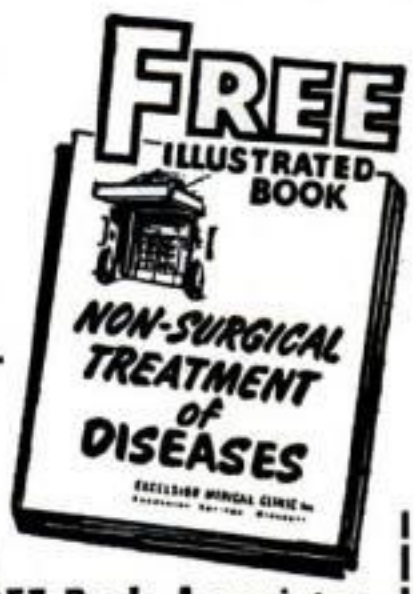

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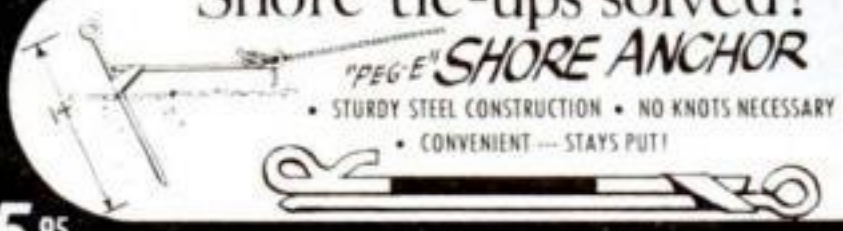

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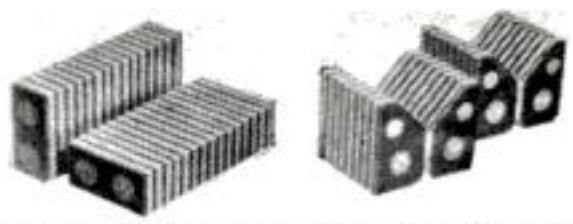

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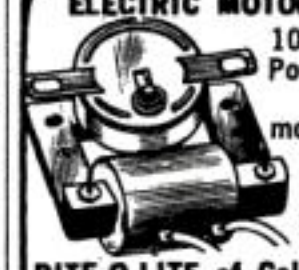

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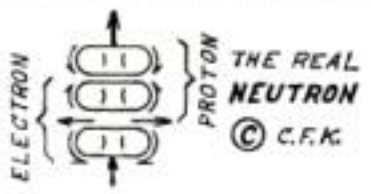

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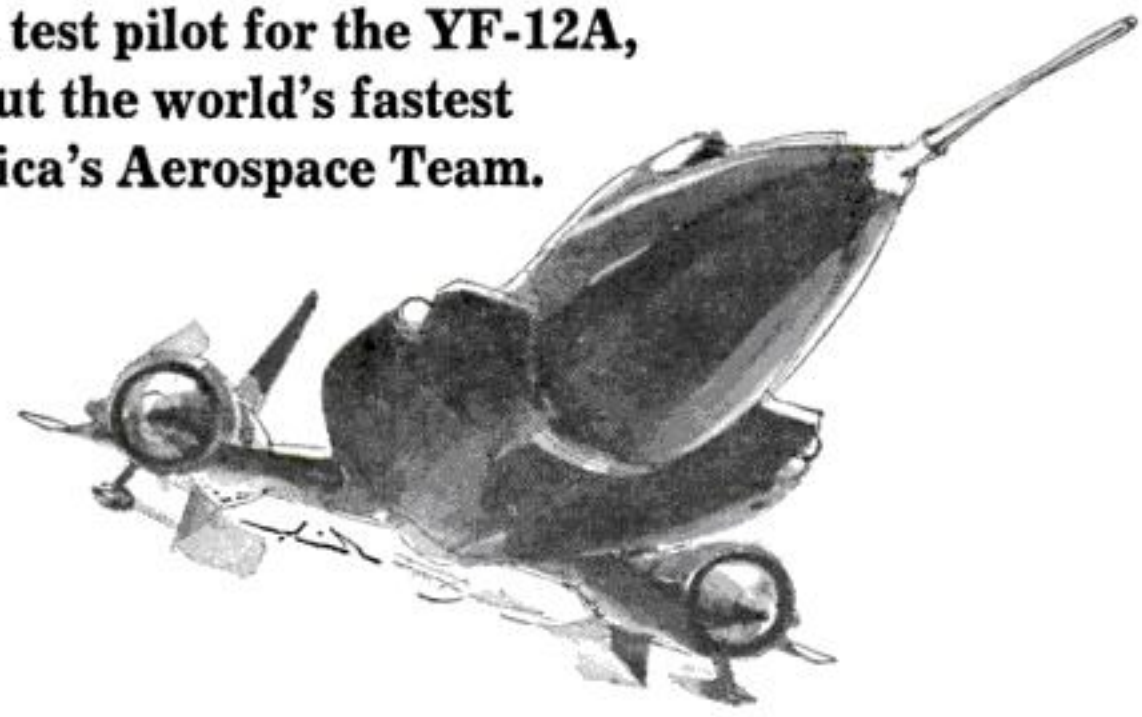

(Maj. Daniel, a test pilot since 1954, is a member of the Society of Experimental Test Pilots. He received a B.S. degree in Aeronautical Engineering from the University of Oklahoma. In February 1962, he set world class time-to-climb records in a T-38 jet trainer.)

How fast has the YF-12A flown?

On May 1 of this year the YF-12A (formerly known as the A-11) reclaimed the world absolute speed record from the USSR. It was clocked at 2,062 mph over Edwards Air Force Base.

How big is the YF-12A?

The exact dimensions of the YF-12A have not been released yet. But it's approximately 100 feet long, with about a 50-foot wingspan. That's half again as big as our present interceptors!

What can I do to get on the Aerospace Team?

If you're going to college, you can join Air Force ROTC, or apply for the Air Force Academy. That way, you'll receive your commission as an Air Force officer at the same time you get your degree. If you're not going on to college, Air Force enlistment is open to you.

Must I be a high-school graduate to get in the Air Force?

At the moment, it's not a requirement. However, the overwhelming majority of airmen do have their diplomas. You see, the more advanced aircraft and rockets become, the more education you need to work with them. At the very least, stay in high school and graduate.

What are my chances of working with an aircraft like the YF-12A?

If you have the right aptitudes and ability, they're good. Of course everyone can't be a test pilot or astronaut. But whatever your Air Force job, you're part of the Aerospace *Team*. Your job is essential to the success of the Air Force mission.

How are Air Force jobs assigned?

Before you enlist you're given an "Airman Qualifying Examination." This test measures your aptitude in four separate career areas. The job you get is based on the scores you make—plus your own desires and the needs of the Air Force.

What sort of training will I receive?

First, you'll have 6 weeks of basic military training at Lackland Air Force Base, near San Antonio, Texas. After that you'll go on to a technical training school or on-the-job training. It costs thousands of dollars to train a man up to Air Force standards, but it gives him a skill that becomes more and more valuable every day.

Can I keep up my studies while I'm in the Air Force?

The Air Force *encourages* its men and women to continue their educations. For instance, you may qualify to study for a degree during off-duty hours, with the Air Force paying a substantial part of the tuition.

What kind of a future do I have in the Air Force?

A bright one. As we move further into the Aerospace Age, the Air Force is going to grow even more important. And you can grow with it!

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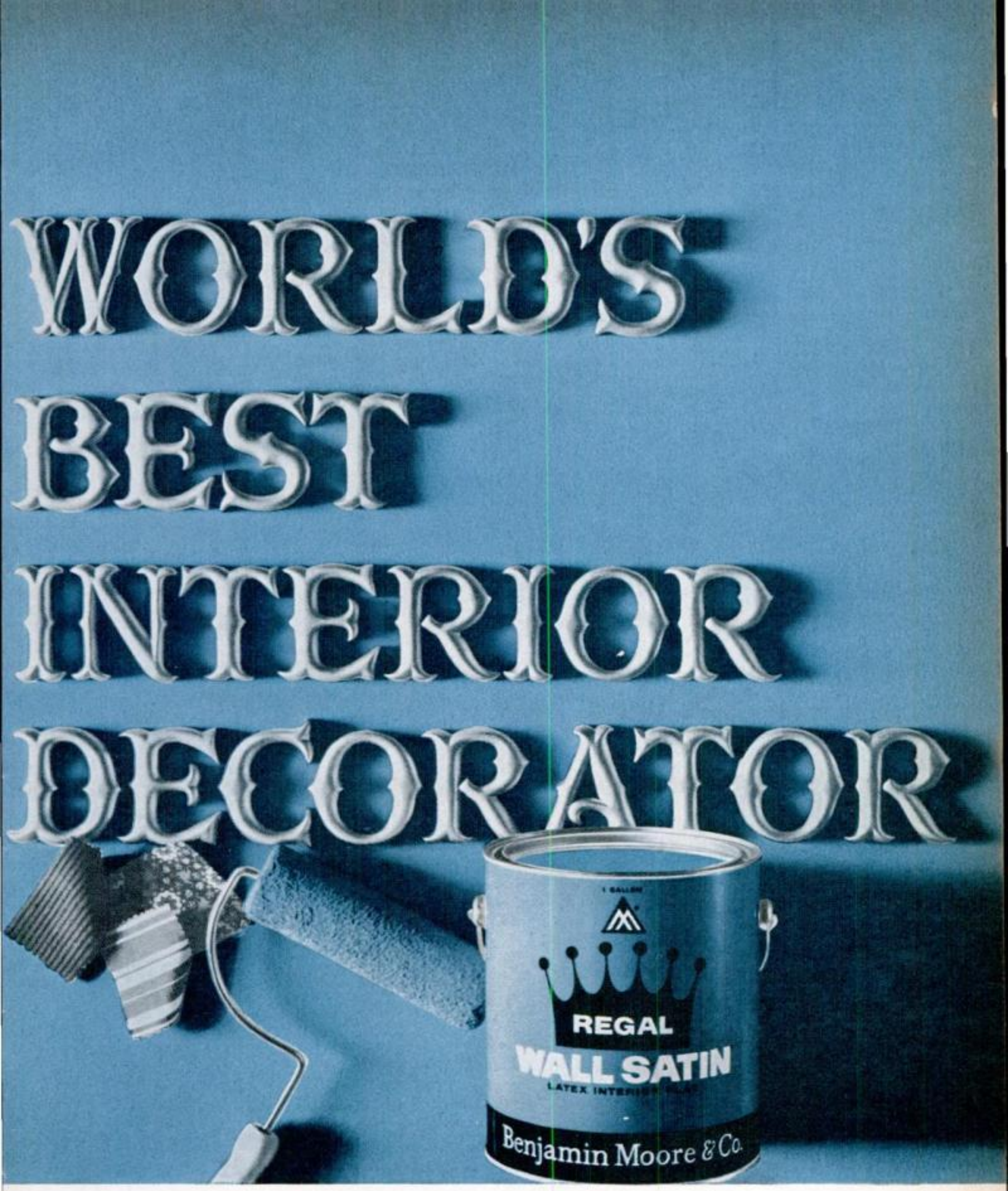

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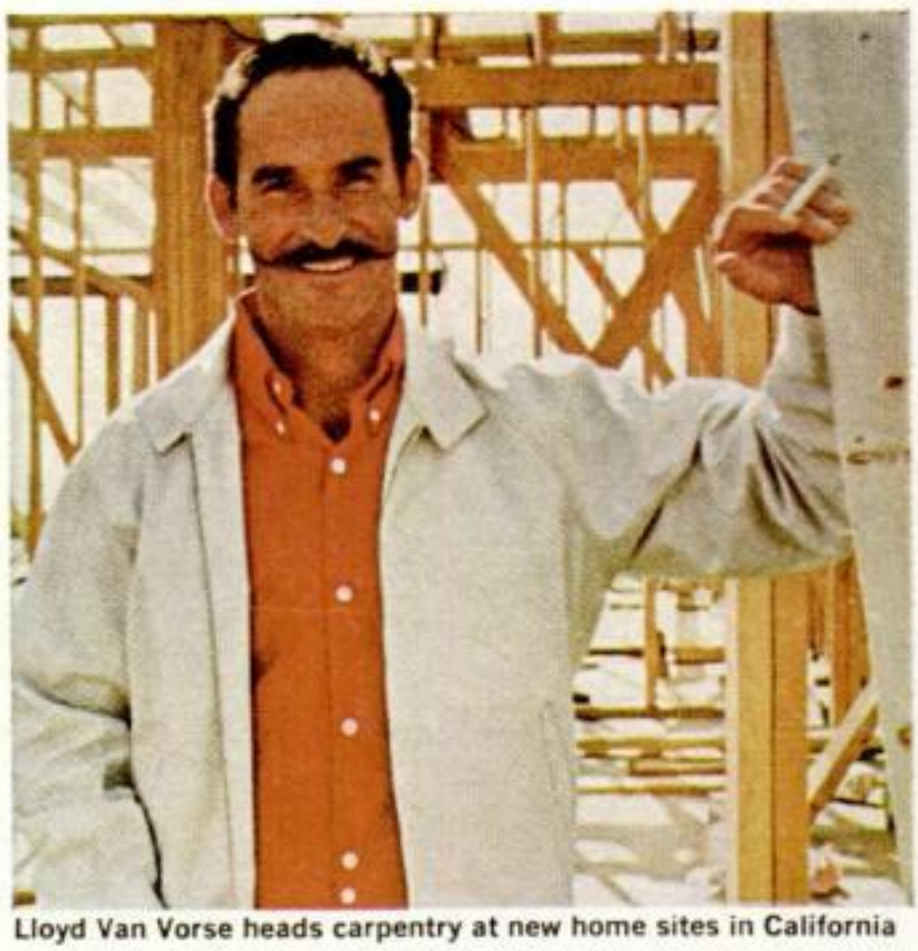
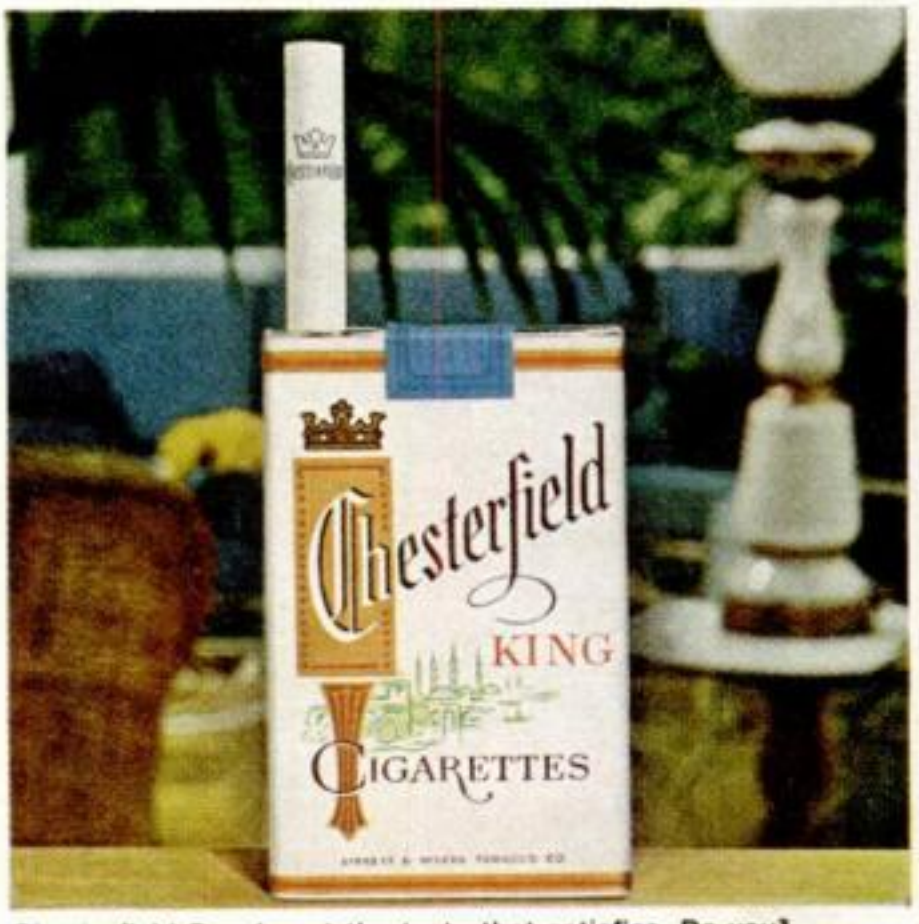


Lloyd Van Vorse heads carpentry at new home sites in California

Robert Thomas arranges transportation at a Nevada hotel



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